Six major elements of sewing

The industrial sewing machine as well as machine tool is the productive goods. The machine has special functions (the functions are largely seen in automatic machines) in addition to the sewing aiming efficiency promotion and deskilling. Also, there are many kinds of the machine.

Basic function of the sewing machine is, however, to stitch using thread whatever the equipment may be. Namely, the first purpose is to form stitches on the cloth and to secure satisfactory quality.

Stitch formation consists of the following six factors. These are called "Six major factors or mechanisms of sewing".

1. Needle bar
2. Hook (looper for chainstitch)
3. Thread take-up lever
4. Feed
5. Presser foot
6. Thread tension

1. Needle bar

1) Function

① Needle bar makes needle up and down, and upper thread penetrate into the material to be sewn.

② Needle bar makes hook or looper scoop the penetrated upper thread.

③ Needle bar scoops looper thread at the needle tip. (For chainstich)

2) Momentum (stroke) of needle bar

The momentum of needle bar is not one kind since the sewing machine sews cloths of various thicknesses. There are three kinds (for heavy-weight, medium-weight and light-weight materials) of momentum for 1-needle lockstitch machine.

When the needle bar stroke is large, there are such merits as ① penetrating force is improved, ② distance from throat plate to upper dead point of needle tip becomes larger and thick material is easily entered, etc. Demerits are ① inertia force is increased and vibration or noise is likely to occur, ② mechanical load is increased and it is not fit to high speed, ③ needle heat rises, etc.

Light-weight materials → small stroke　　Heavy-weight materials → large stroke

Example : DDL-5550 = 30.5 mm/DDL-5550H = 35 mm/DDL-5550A = 29 mm/LG-158 = 46.88 mm

H type = for heavy-weight materials　　A type = for light-weight materials

3) Needle

Needle is attached to the top of needle bar and is one of the most important parts to sew materials.

If needle is not good, it will be the cause of various troubles such as thread breakage, material breakage, puckering (wrinkle by sewing), etc.

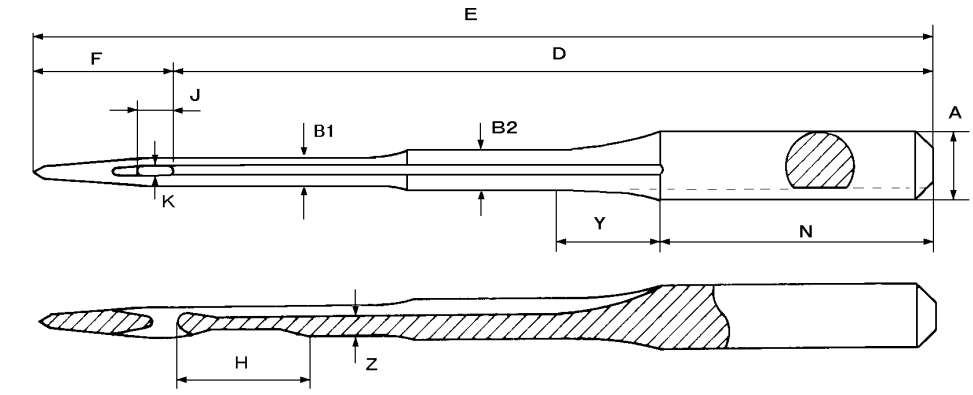
If there is any problem related to the sewing, it is general to check whether threading is proper, then to check whether needle is defective.

Example of blunt needle tip

<Normal> <Blunt needle tip>

<Photo. Ⅲ-1> **<Photo. Ⅲ-2>**

① Symbol of dimension and name



A : Shank diameter
B : Shoulder diameter
E : Length of needle
D : Butt to eyelet
J : Length of eyelet
K : Width of eyelet
N : Length of shank
H : Length of scarf
Z : Detpth of groove
F : Length of point

Shape of scarf **Standard type shape** **Boat-shaped type**

<Fig. Ⅲ-1>

② Shank diameter : A = Mainly divided into the following three systems.

For overlock system	DC x 1, DC x 27	... 2.02 mm
For lockstitch system	DA x 1	... 1.62 mm (#7 to #22)
	DB x 1	... 1.62 mm (#7 to #18)
		... 1.90 mm (#19)
		... 2.02 mm (#20 or more)
For special sewing machine system such as straight buttonholing or the like	DP x 5	... 2.00 mm

* For the shank diameter to be used in overseas, refer to "Reference data 1" in the end of this volume. (P.61)

③ Butt to eyelet (Length between top end of eyelet and top end of shank) : D

This is the most important dimension for hook or looper to scoop thread loop, and the length of D is fixed even when thickness of needle (needle size No.) varies.

④ Length of needle : E

For DB x 1, DP x 5, etc., whenever the shank gets thicker, the length of needle gets longer. DC type needles are for overlock and chainstich and the total length is fixed since it is required to scoop looper thread at the needle tip.

⑤ Thicknes (needle size)

Thickness is dimension B1 and shown as needle size. Generally, a needle consists of 2-step stretched wire in which there is the trunk B2 thicker than the trunk B1. (DC x 1 and DC x 27 consist of one-step stretched wire since the whole length is short.)

Dimension B1 (needle size) prevents the needle from vibration and protects the rise of needle heat by reducing friction when the needle comes off cloth.

Conversion table of needle size of various countries **<Table Ⅲ-1>**

Sizes			Needle trunk sizes	Sizes			Needle trunk sizes
ORGAN (Japan)	GERMANY	UNION (U.S.A.)	ORGAN (Japan)	ORGAN (Japan)	GERMANY	UNION (U.S.A.)	ORGAN (Japan)
5	45	/	0.47	16	100	040	1.02
6	50	/	0.52	17	105	042	1.07
7	55	022	0.57	18	110	044	1.12
8	60	/	0.62	19	120	048	1.22
9	65	027	0.67	20	125	049	1.27
10	70	029	0.72	21	130	/	1.32
11	75	030	0.77	22	140	054	1.42
12	80	032	0.82	23	160	/	1.62
13	85	034	0.87	24	180	078	1.82
14	90	036	0.92	25	200	080	2.02
15	95	038	0.97	26	230	090	2.30

* For the SCHMETZ (Germany) version, refer to "Reference data 2" in the end of this volume.(P.61)

⑥ Length of shank : N

If the length of shank N gets longer, it is better for needle-wobbling or needle-bent. However, if the shank portion enters material, it will cause material breakage or puckering. As a result, the length within the range that the shank does not enter material is good.

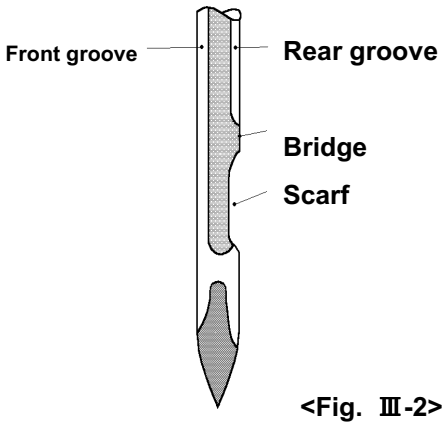
⑦ Shape of scarf

The typical shapes of scarf are of standard type and of boat type. The boat type shape is good for making needle thread loop and effective to protect stitch skipping. However, the blade point to scoop needle thread should be positioned at the height where it does not come in contact with the lower portion of scarf. In addition, resistance at upper and lower angle portions of the scarf slightly increases when raising or lowering material.

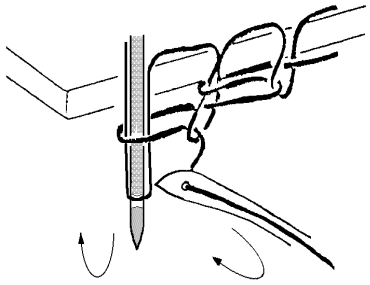
⑧ Rear groove on needle

Needle with rear groove is used for overlock and double chainstitch sewing machines (MO, MF, MH, etc.). It reduces resistance of thread that occurs when needle penetrates material and improves thread tightness when needle is in its lowest position.

However, there is a bridge (no-groove portion) to improve loop making since resistance of thread due to material is reduced when needle goes up from its lowest position. (Length of bridge varies in accordance with needles.)



<Fig. Ⅲ-2>



<Fig. Ⅲ-3>

⑨ Shape of needle tip

Shape of needle tip **<Table Ⅲ-2>**

Tip point	Symbol	Shape of needle tip	Shape of point	Application and feature
Sharp and slim type point	SPI			Light-weight fabrics, light-weight leather
Regular type point	R			General fabrics
Butt type point	BUT			Mainly for button sewing
Slim point	S			Slim shape and J point at needle tip, for high-gauge knit
J ball point	J			For general knit, suitable for standard material as well
B ball point	B			For relatively coarse knit, Ball is ϕ 1/5 of trunk
U ball point	U			For knit and power-net, Ball is ϕ 1/3 of trunk
Y ball point	Y			For elastic materials, Ball is ϕ 1/2 of trunk
Flat tip shape	LL LR			45° twisted type knife needle Mainly for leather goods 45° reversely twisted knife needle

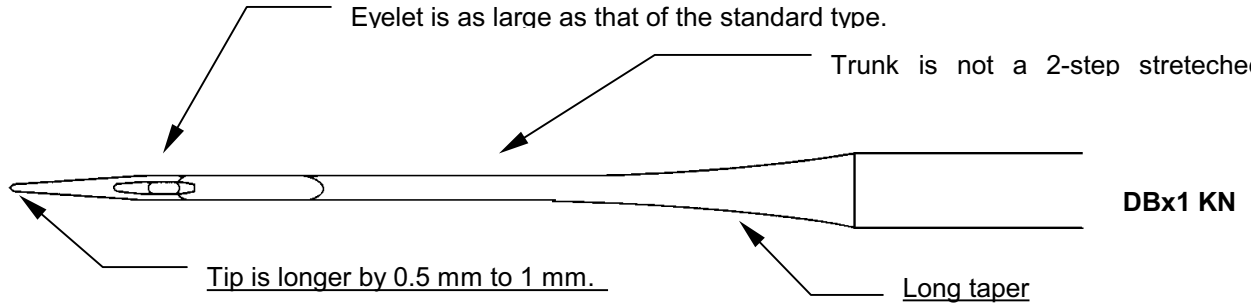
* For the overseas version of the needle tip point, refer to "Reference data 3" in the end of this volume.(P.63)

⑩ Exclusive needle for knit

This is a needle that does not break material with its tip, and this is improved penetration of needle to material.

It is effective against material breakage and protection of puckering.

-1 : KN needle (for high-gauge knit material)



<Fig. Ⅲ-4> Slim shape and ball point (regular point J, optional points B, U and Y)

-2 : SF needle (for ultra fine-gauge knit)

This needle is slimmer by one size than KN needle from needle tip to near to eyelet.

⑪ Needle for new synthetic fiber (NS needle)

This is a needle that resistance of needle penetration of the exclusive needle for knit is further recuced, and is useful for puckering prevention.

Shape is almost the same as that of SF needle, but sharp-pointed from needle tip which makes resistance of needle penetration the least.

⑫ Surface treatment

-1 Nickel plating

This plating is full of corrosion resistance and generally used for the home-use sewing machine.

-2 Chrome plating

Generally, hard chrome plating is made on the needle, and the needle is superior in heat-proof and wear proof. The needle is used for the industrial sewing machine.

-3 Teflon coating

Slide is the best, but durability of coating effect is low.

-4 Titanium coating

Wear proof and heat-proof are best, and this needle is used for extra heavy-weight material or the like.

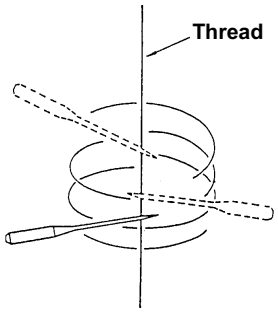
⑬ Needle-to-thread relation

【 How to check proper needle size 】

Pass thread used of an appropriate length (approx. 50 cm) through needle, hold both ends of the thread, stretch it vertically as shown in the illustration and slide the needle.

When the needle slides down while slowly turning, it can be said that the size of needle is proper for the thread.

If the needle does not slide down or slides down without any resistance, stitch failure (stitch skipping, thread breakage or stitch looseness) is likely to occur.



<Fig. Ⅲ-5>

Table of proper relations between needle and thread **<Table Ⅲ-3>**

Needle size	Spun thread	Filament thread	Main application
#5 to #6	#120	#100	Extra light-weight nylon material and blouses
#7 to #8	#100	#80 to #100	Shirts, knit wear
#9 to #10	#80	#60 to #80	Ladies' dress, pyjamas
#11 to #12	#60	#50 to #60	Gents' suits, students' uniform
#13 to #14	#40 to #50	#40 to #50	Wool fabrics, gents' suits
#16	#30 to #40	#30 to #40	Working wear, jeans
#18	#20 to #30	#20 to #30	Jeans, coat
#19	#10 to #20	#10 to #20	Heavy-weight materials such as denim, sheet, etc.
#20 to #21	#8 to #10	#5 to #10	Heavy-weight materials such as tent, sheet, etc.
#22 to #26	#8 or less	#5 or less	Extra heavy-weight materials such as canvas or the like

⑭ Kind of needle and applicable model <Table III-4>Kind of needle and applicable model **<Table Ⅲ-4>**

Kind	Size and shape of needle tip	Main application	Applicable model
DB x 1	#7 to #25	General sewing	General 1-needle lockstitch sewing machine DDL-5530N DDL-5550N DDL-5700
DB x 1738	#8 to #22	Ditto, Scarf is longer than that of DB x 1.	
DB x 1KN	#8 to #14 (J)	For knit, trunk is smaller by one size and needle tip is slim.	
DB x 1SF	#9 to #11 (J)	For ultra fine knit, resistance of penetration is smaller than KN.	
DB x 1NS	#8 to #11 (SPI)	For new synthetic fiber, resistance of penetration is the least.	
DB x K5	#9 to #18	For embroidery and thick needle, eyelet is larger by two sizes.	
DB - K23	#9 to #12 (J)	For knit stitch, eyelet is larger than that of KN.	
DB - N20	#11, #14, #16	For heavy-materials, Shank is shorter by approx. 3 mm than that of DB x 1.	
DB x A20	#19 to #23	For heavy-materials, shank diameter is 1.62 mm.	
DB x 1ST	#20, #22 (J)	For decorative stitch, trunk is smaller by one to two sizes and eyelet is larger by two to three sizes.	DDL-201S, DU-141S
DB x 3ST	#11 to #22 (J)	For decorative stitch, shank of #19 or less is 2.02 mm. Trunk is smaller by one to two sizes and eyelet is larger by two to three sizes.	
DA x 1	#7 to #22	For light-weight materials sewing by 1-needle lockstitch sewing machine	DDL-5550NA or the like
DA x 1KN	#8, #9 (J)	For light-weight materials sewing, trunk is smaller by one size and needle tip is slim.	For knit
DP x 5	#6 to #25	For general special machines, N = 11.50 to 12.50	LK-1900 LBH-790RS-1 LH-3128-7 LZ-2280N-7 AMS
DP x 5KN	#9 to #12 (J)	For knit, trunk is smaller by one size and needle tip is slim.	
DP x 134	#9 to #18	Shank is longer by 1 mm and scarf is of boat type.	
DP x 7	#8 to #25	Shank is shorter by 1 mm and N = 11 mm fixed.	
DP x 17	#9 to #26	For 2-needle lockstitch, it is longer by 5 mm than DP x 5.	
DP - N31	#14, #16, #18	For 1st process of lockstitch button sewing, Shank is shorter by 4.5 mm than that of DP x 17.	LK-1851-555
DC x 27	#6 to #24 (J up to #11)	For overlock machine, Scarf is of boat type (stitch skipping prevention)	General overlock machines MO MOR MOC MOF
DC - J27	#9 to #16	No rear groove on needle (stitch skipping prevention)	
DC x 1	#7 to #25 (J up to #11)	For overlock machines, No scarf on #7 to #8	
DC x 1KN	#8 to #14 (J)	For knit, Scarf is of boat type. Trunk is smaller by one size and needle tip is slim.	
DC - N17	#6 to #19	For blind overedging, Shank is longer by 3 mm (needle vibration prevention).	
DC - N25	#7 to #11	For blind overedging, Shank is longer by 1.5 mm (needle vibration prevention).	

*For the common needle symbols to SCHMETZ and others, refer to "Reference data 4" in the end of this volume.(P.64)

Kind	Size and shape of needle tip	Main application	Applicable model
DC x 3	#6 to #22	For needle gauge 1.6 mm Shank diameter : 1.22 mm	2-needle overlock
DC - C46	#7, #9, #11	For needle gauge 0.8 mm Both sides of shank are cut, and others are same as DCx1.	
DC - C47	#7, #9, #11	For needle gauge 1.2 mm Both sides of shank are cut, and others are same as DCx1.	
TV x 64	#8 to #22	Scarf is of boat type (stitch skipping prevention).	MOG
TV x 64 NY	#8 to #22	Tapered shape (needle vibration prevention)	MS-1190
TQ x 1	#9 to #22 (BUT)	Length is shorter by 10 mm than that of TQx7 (needle vibration prevention).	MB-377
TQ x 7	#9 to #24 (BUT)	For chainstitch button sewing Whole length : 51 mm	MB-372.373
TF x 2	#7 to #25 (LL)	Knife needle for 1-needle lockstitch	
TF x 2 LR	#8 to #25 (LR)	Knife needle for 1-needle lockstitch	
DB x F2	#9 to #25 (LR)	Knife needle for 1-needle lockstitch	
DD x 1	#16 to #29	For leather and canvas	LG-158
DI x 3	#12 to #25	For heavy-weight materials Shank is shorter by 3 mm than that of DPx17.	LU-562/563
DN x 1	#18 to #27	For extra heavy-weight materials Diameter of shank is same as that of trunk.	LU-563-3
TV x 1	#8 to #23	For double chainstitch Scarf is not provided up to #18 and provided from #19.	
TV x 7	#8 to #25	For double chainstitch Shape is same as TVx1 and scarf is provided.	ML-111, MH-380/481 LT-591
UY x 128 GAS	#6 to #23	For covering stitch	MF,MFC. MFB
MT x 190	#9 to #24	Trunk portion is long and used for automatic welting machine.	APW-194
MT - G79	#16	Feed direction : #16, Lateral direction : #14	

* Shape of needle tip

No mark means R point. There are various ball points and super needles as optional.

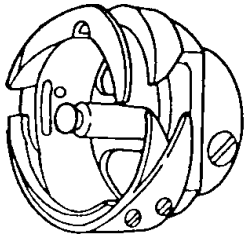
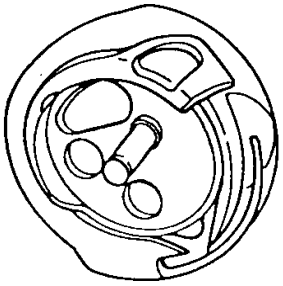
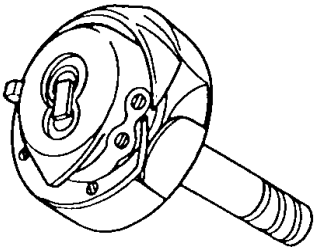
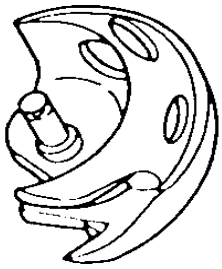
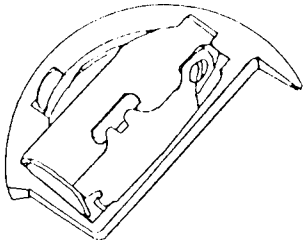
2. Hook

1) Function

① Hook is divided into outer hook and inner hook. Outer hook scoops upper thread from needle, rotates periphery of inner hook and interlaces with lower thread (bobbin case) which is set to inner hook to form stitches.

② Semi-rotary hook scoops upper thread with the inner hook.

2) Kind of hook **<Table Ⅲ-5>**

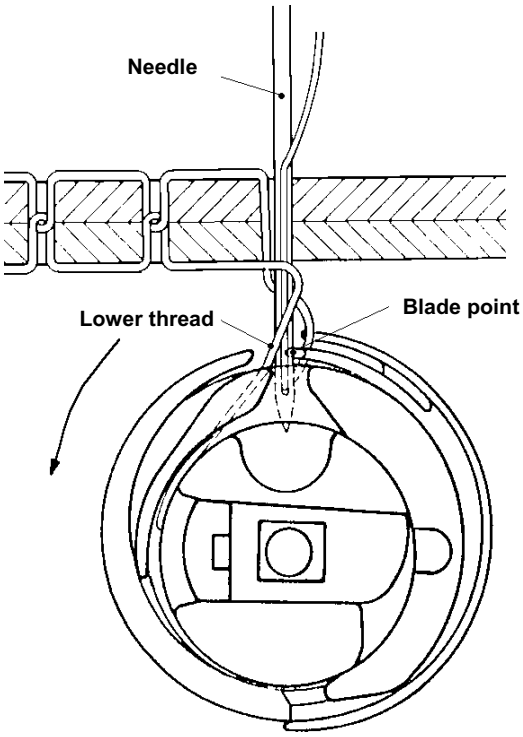
DB type Horizontal full rotary hook (Horizontal 2-rotation hook)		DDL-5550N, LZ-586U, etc. This hook is vertically set to hook driving shaft, and hook driving shaft rotates two times when needle bar travels one time. This hook is used the most for the industrial sewing machine and there are many kinds. • Normal feed : perfect stitch • Reverse feed : hitch stitch
DP type Horizontal full rotary hook (Horizontal 2-rotation hook)		LBH-770-1, LBH-790RS-1, LZ-2280N-7 This hook is used for zigzag sewing and embroidery sewing machines since perfect stitch can be obtained regardless of sewing direction. • Rotation is reverse to that of DB type. • It is apt to occur that thread is caught on race surface.
Vertical full rotary hook (Vertical 2-rotation hook)		LH-3128-7, LU-563N, LU-2210N-7, etc. This hook is developed for 2-needle sewing machine, but used for sewing machine with 1-needle to sew heavy-weight materials. • Regardless of sewing direction, perfect stitch can be obtained. • Opener (thread handling) is required to improve slide of upper thread.
Horizontal semi-rotary hook (Inner hook)		LK-1900, LK-1850, AMS Series • This hook is suitable for heavy-weight materials since correspondence to change of material thickness is good. • This is not suitable for high-speed because of oscillating motion. • Perfect and hitch stitches are made.
Shuttle hook		TSU-471, 421, 441 • Stitches are well-tightened. This is suitable for sewing shoes, bags, etc. • Perfect and hitch stitches are made.。

3) Full rotary hook

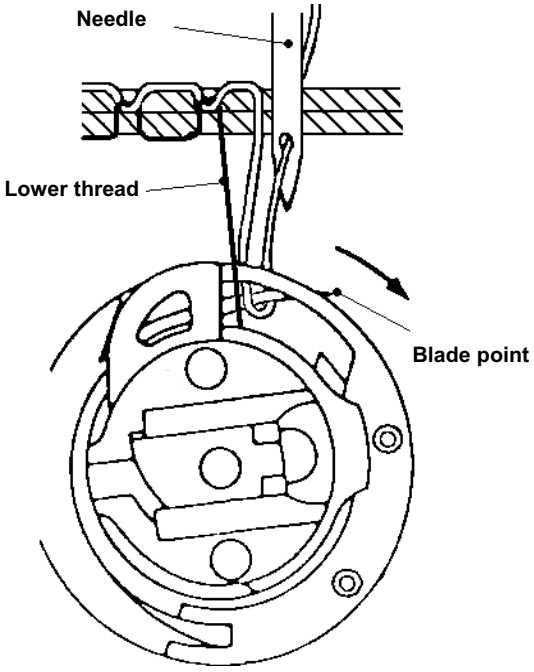
Full rotary hook is roughly divided into DB type and DP type.

① Difference between DB type and DP type **<Table Ⅲ-6>**

	DB type	DP type
Rotating direction as observed from the front of hook	Left-hand rotation	Right-hand rotation
Position of needle thread and blade point in terms of bobbin thread	Bobbin thread, needle, blade point	Bobbin thread, blade point, needle
Needle thread pulled in hook (needle side)	Needle thread rotates around rear side of inner hook.	Needle thread rotates around front side of inner hook.
Normal feed	Perfect stitch	Perfect stitch
Reverse feed	Hitch stitch	Perfect stitch

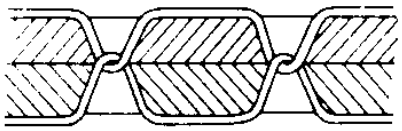


<Fig. Ⅲ-6>



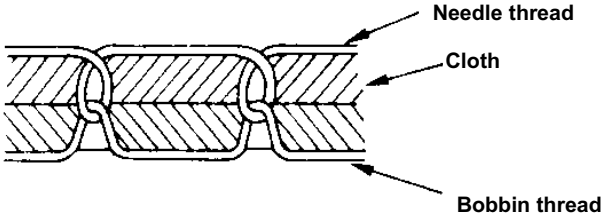
<Fig. Ⅲ-7>

Perfect stitch



<Fig. Ⅲ-8>

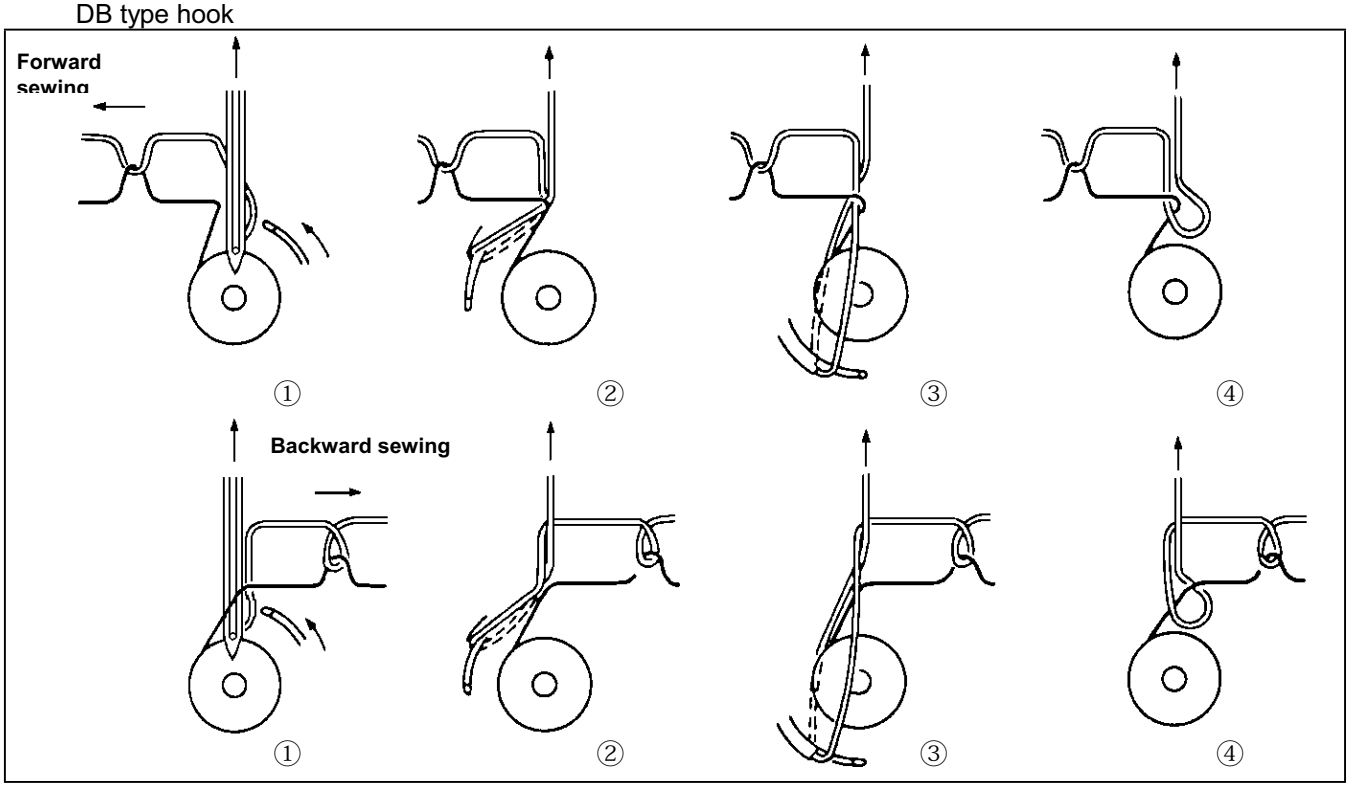
Hitch stitch



<Fig. Ⅲ-9>

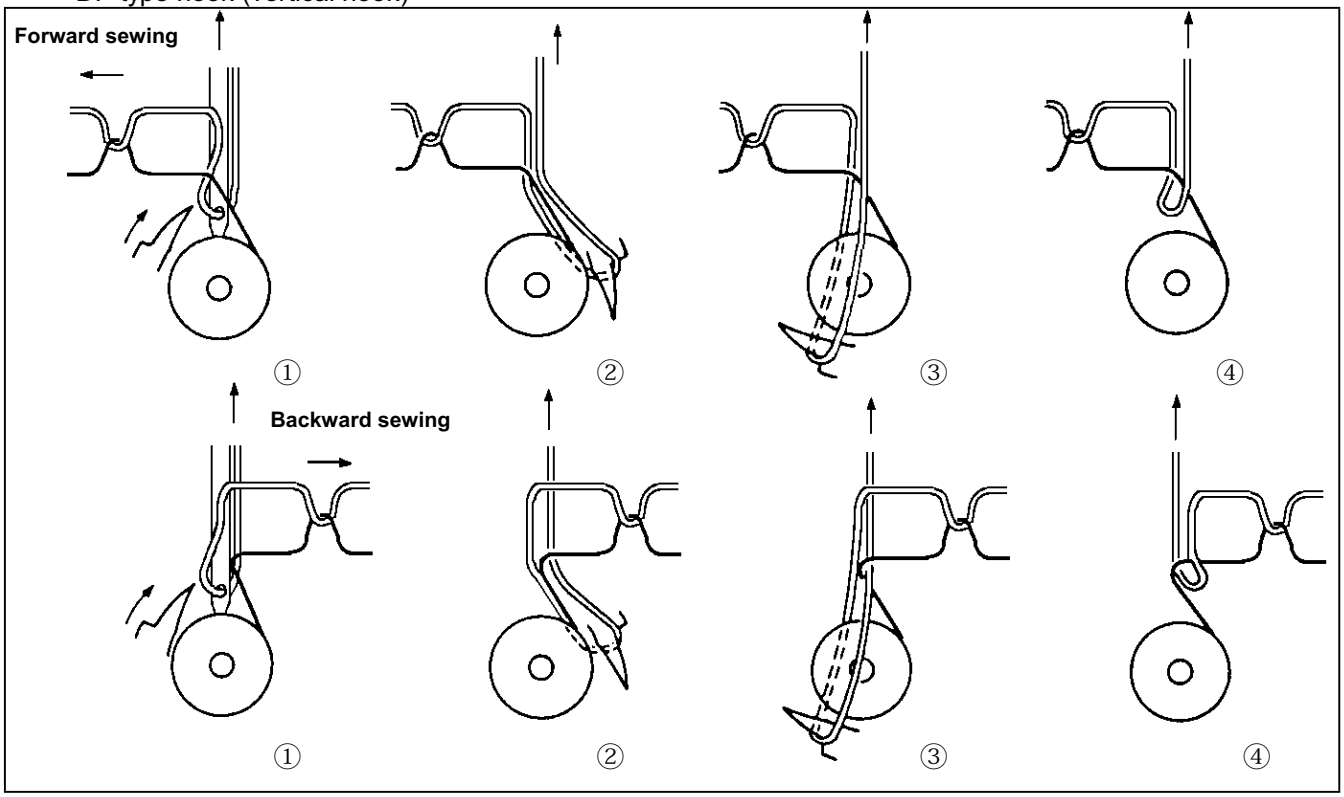
② Stitch type

DB type hook



<Fig. Ⅲ-10>

DP type hook (vertical hook)

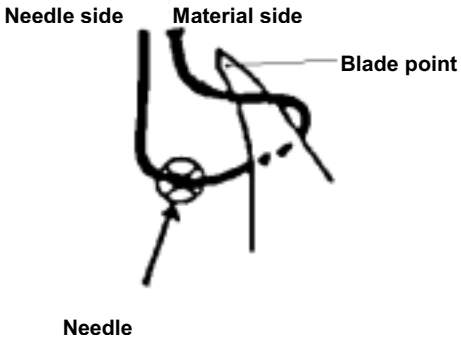


<Fig. Ⅲ-11>

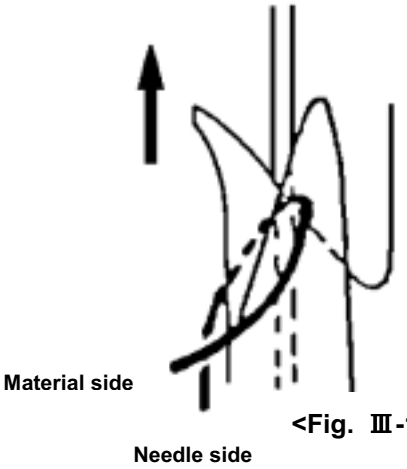
③ Upper thread motion of DB hook

a : Blade point of outer hook catches upper thread (loop).

b : Upper thread moves into the inner side of blade point following the rotation of hook.

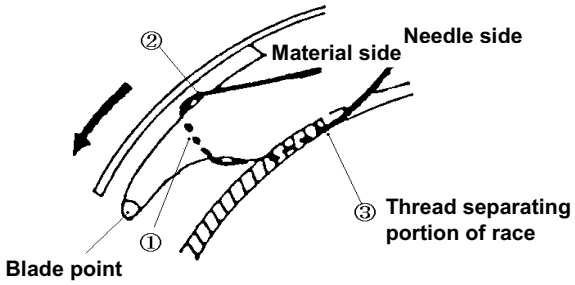


<Fig. Ⅲ-12>

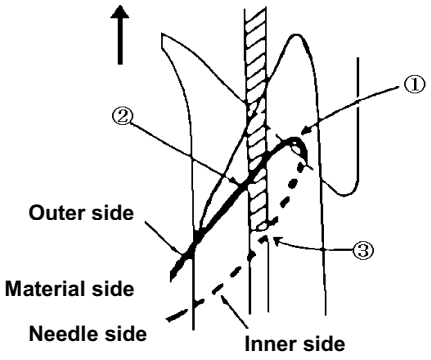


<Fig. Ⅲ-13>

c : Upper thread is separated to inner side and outer side of inner hook at thread separating portion of race.

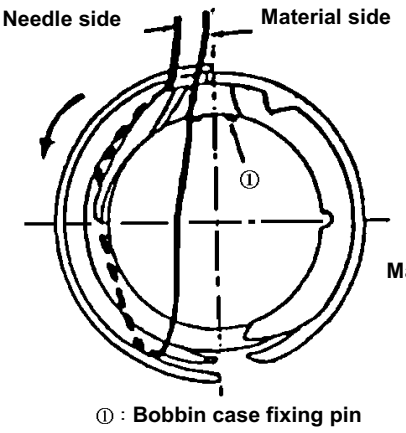


<Fig. Ⅲ-14>

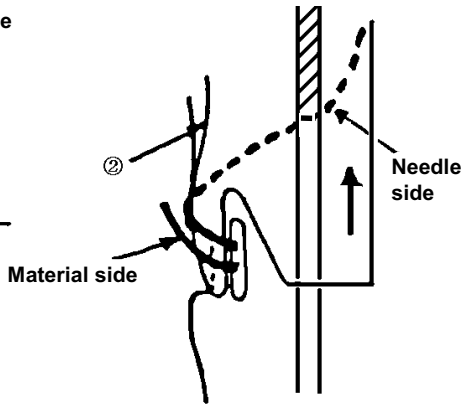


<Fig. Ⅲ-15>

d : Immediately before upper thread passes through inner hook



<Fig. Ⅲ-16>

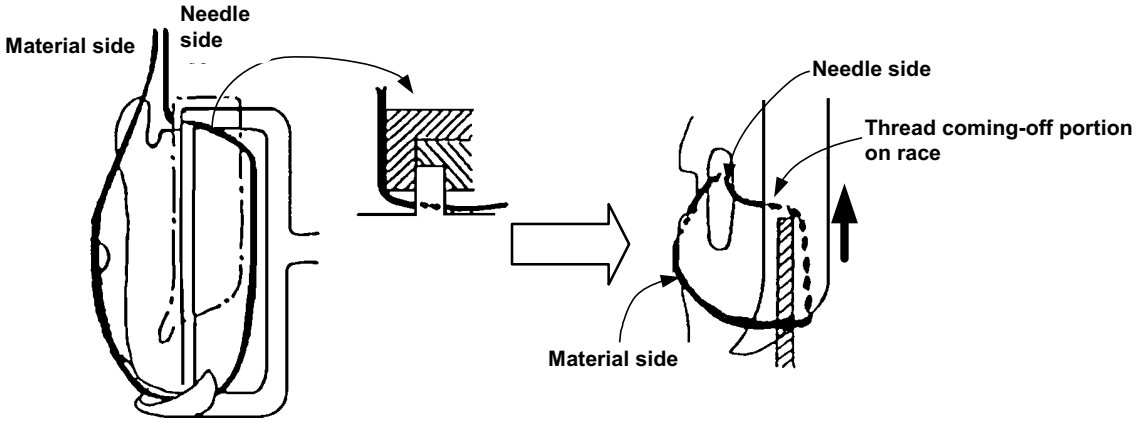


<Fig. Ⅲ-17>

Swell at portion ② of H type for thick thread and heavy-weight materials is largely swollen outward so as to improve crossover of thread on bobbin case. Thread is well-tightened at high-speed.

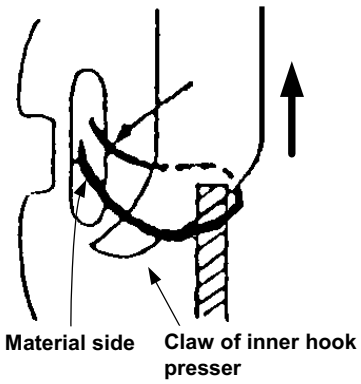
Also, lower thread is fed.

l : Thread take-up lever starts lifting upper thread.

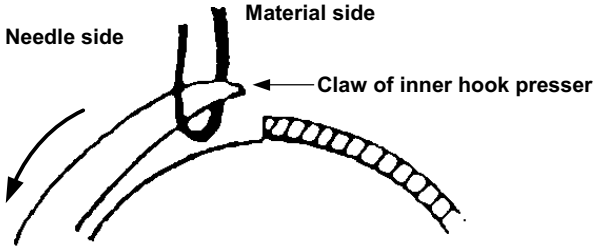


<Fig. Ⅲ-18>

f : Thread comes off hook and is caught on the claw portion of inner hook presser.



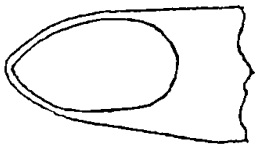
<Fig. Ⅲ-19>



<Fig. Ⅲ-20>

④ Blade point of hook

-1 Shape of blade point



Standard type

<Fig. Ⅲ-21>

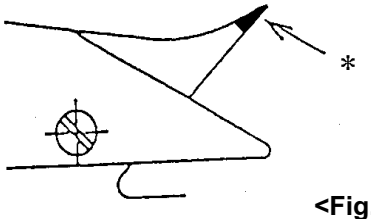
Tear-drop type It is hard to be blunt.

<Fig. Ⅲ-22>

SP type It is good for stitch skipping, but is apt to be blunt.

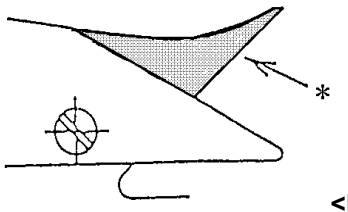
<Fig. Ⅲ-23>

Hard point hook (HP hook) ✱ :
Reinforcing agent is welded at tip portion.



<Fig. Ⅲ-24>

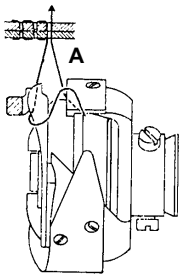
Hard chrome plating hook (CR hook) ✱ :
Hard chrome plating is made on the whole outer hook.



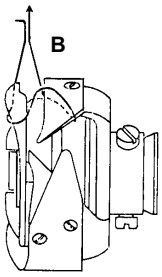
<Fig. Ⅲ-25>

⑤Type of DB hook

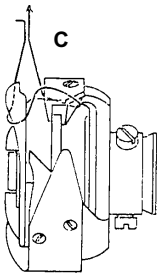
There are basic types of A, B, C, D, E, and F for DB hook. These types have the respective features.



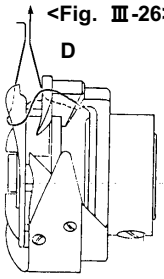
<Fig. Ⅲ-26>



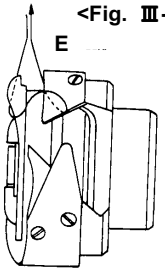
<Fig. Ⅲ-27>



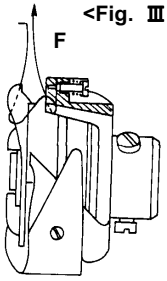
<Fig. Ⅲ-28>



<Fig. Ⅲ-29>



<Fig. Ⅲ-30>



<Fig. Ⅲ-31>

Type A **<Fig. Ⅲ-26>**

This is for heavy-weight materials or zigzag stitching, and thread coming-off timing is most advanced, comparing with other types. Accordingly, even when this is set at rather delayed timing, thread coming-off from hook is not so hard.

Type B **<Fig. Ⅲ-27>**

This is a general type covering from heavy-weight to light-weight materials. The feature is that the claw of inner hook presser is stretched long.

This claw holds needle thread for a relatively long period of time when the thread comes off from hook and works to get rid of the excessive slack.

Accordingly, it is effective to protect looping (towel face which often occurs at the wrong side of material) when using tightly-twisted thread or hard-to-slide thread.

Type C **<Fig. Ⅲ-28>**

This is used for both medium-weight and light-weight materials and has a projection to protect thread bite which prevents needle thread from entering into the gap between outer hook groove and hook race when the thread comes off from hook. As shown in the illustration, thread rides on this projection to prevent from being bit, and simultaneously is held to a certain extent by this projection to get rid of the excessive slack.

Further, whole length of outer hook gets long with this projection resulting in increasing durability and protecting occurrence of hook noise.

Type D **<Fig. Ⅲ-29>**

This combines the merit of type B and type C. Similar to type B, this has the claw of inner hook presser to hold the slack of needle thread, and similar to type C, this has a projection to protect thread bite. Further, another feature is that this is designed to reduce as much as possible the resistance when thread comes off from hook by lightening weight of inner hook and reducing moment of inertia. Therefore, better stitching can be obtained even for hard-to-sew thread such as slim and weak thread, synthetic thread, etc.

Type BOH **<Fig. Ⅲ-30>**

This is for medium-weight and heavy-weight materials and designed so that even when using thick and less-twisted soft thread, thread smoothly comes off and looping does not occur by shortening the claw of inner hook presser.

Type F **<Fig. Ⅲ-31>**

This is developed for semi-industrial sewing machine. The type belongs to type A. However, the feature is that inner hook presser is constructed (jam proof) to be assembled with a screw through coil spring. Even when thread bite occurs during sewing, thread bit in hook can be taken out without disassembling the hook. There is a hook in this type that can perform zigzag stitching of home-use sewing machine.

Type HSM (double-capacity hook)

Bobbin is made large to improve sewing efficiency and amount of thread winding is double as much as the standard when using thick bobbin thread or the like. This can be used for heavy-weight material, stitch sewing, etc.

Type HST (3-fold capacity hook)

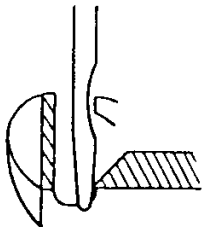
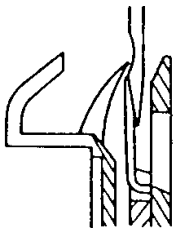
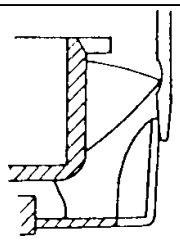
Amount of bobbin thread winding is approximately three times as much as the standard to improve further sewing efficiency of extra thick thread or extra heavy-weight materials. There are two kinds of type A and type B which can be used for the exclusive sewing machine to sew pattern stitching or the like in accordance with the application.

4) Needle guide of hook

Needle guide is attached to hook excluding exception. Needle guide is the most important part to protect blade point of hook and keep hook from damage, and also plays an role of protecting needle breakage.

The following table gives typical examples of needle guide.

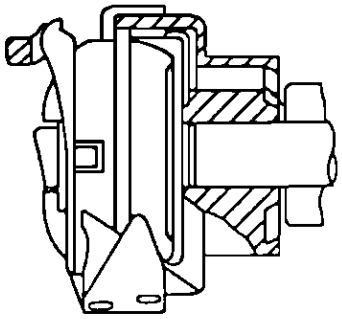
Type and characteristics of needle guide **<Table Ⅲ-7>**

Type	Illustration	Description
DB series		Generally, this needle guide is used without applying needle guard (up to #21). However, there is a needle guard type needle guide corresponding to thin needle (up to #11) as well.
DP series		This needle guide is attached to DP series hook and the portion of needle guide can be adjusted in accordance with thickness of needle.
12 series 11 series		This needle guide is attached to hook for relatively light-weight materials of 2-needle vertical hook. Portion of needle guide can be adjusted in accordance with thickness of needle.

5) Lubricating hook

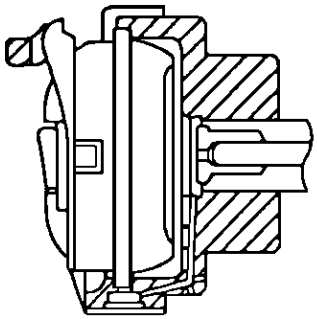
① Lubricating mechanism of DB hook

For the DB series hook, there are semi-high speed type, mechanism of which is to absorb a part of oil lubricated to hook driving shaft bushing into inside hook, and automatic lubrication type to forcibly lubricate from a hole in the center of hook driving shaft. There are closed type and open type for the automatic lubrication type.



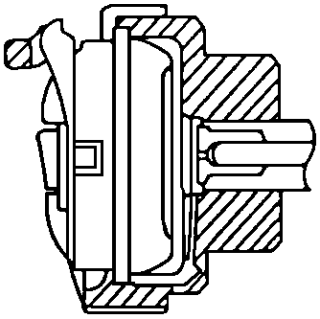
Semi-high speed type

<Fig. Ⅲ-32>



Closed automatic lubrication type

<Fig. Ⅲ-33>



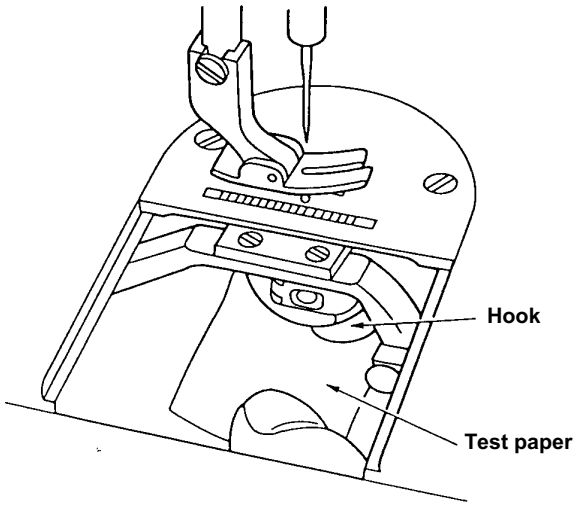
Open automatic lubrication type

<Fig. Ⅲ-34>

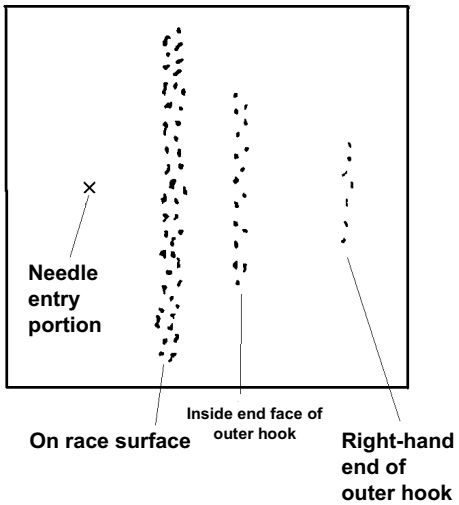
② Amount of lubrication

-1 Way of confirmation

After making the sewing machine run idle for approximately 10 seconds, place test paper while making the machine run idle for 5 to 10 seconds, and judge the amount of lubrication by the splashes of oil on the test paper.



<Fig. Ⅲ-35>



<Fig. Ⅲ-36>

-2 Appropriate amount of oil

Appropriate amount of oil for 5 seconds is such an extent as shown in the above right-hand illustration. Necessary places of oil are especially on race surface and oil splashes slightly in the inside end face of outer hook and right-hand end of outer hook.

* When thick thread or hard-to-slide thread is used.

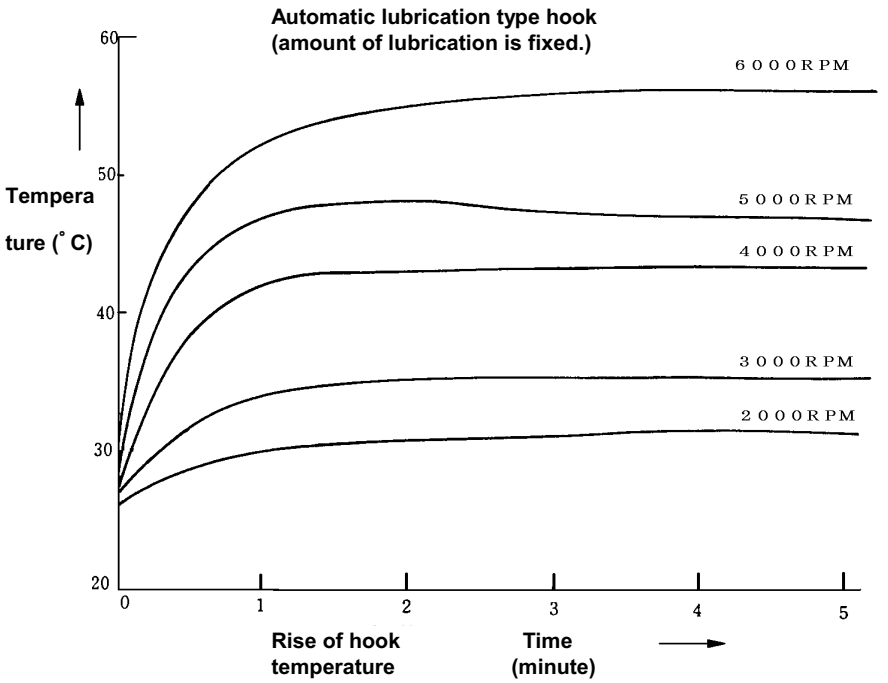
Thread tightness is improved when increasing the amount of lubrication to such an extent that oil is not attached to the sewing products.

* When thin thread or especially, synthetic thread is used.

It is better to decrease amount of lubrication to such an extent that hook is not seized. However, seizure of race surface occurs if amount of oil is excessively decreased.

As a result, motion of inner hook is deteriorated, and hook noise or hook temperature is increased. Also, dirt of needle thread (thread gets dark) may occur.

-3 Rise of hook temperature



<Fig. Ⅲ-37>

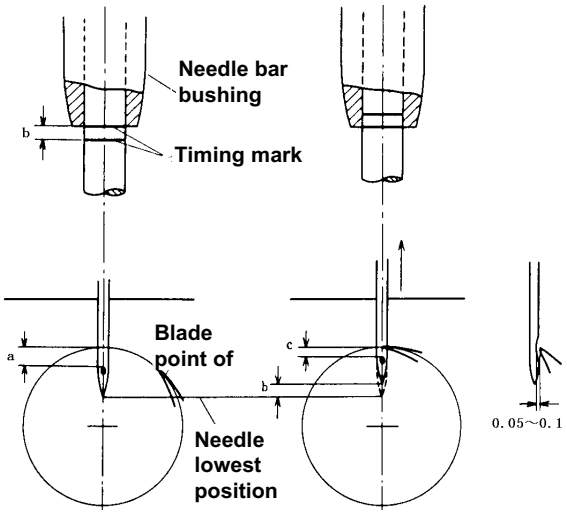
Temperature of hook which rotates at high speed rises, however, the extent of rise of temperature varies in accordance with number of revolutions, continuous rotating time and amount of lubrication.

Rise of hook temperature should not be worried except for abnormal cases. However, it should be careful about the lubricating condition

6) Hook timing

When timing marks are attached to needle bar, make sure that upper line of timing mark is aligned with lower end of needle bar bushing in the state that needle bar is lowered to its lowest position.

When they are not aligned with each other, adjust the position of needle bar. Next, when needle bar goes up from its lowest position and lower line of timing mark is aligned with lower end of needle bar bushing, adjust blade point of hook to the center of needle to attach the hook.



<Fig. Ⅲ-38>

b = Hook timing (phase)

c = Position of needle bar (height)

a = b + c

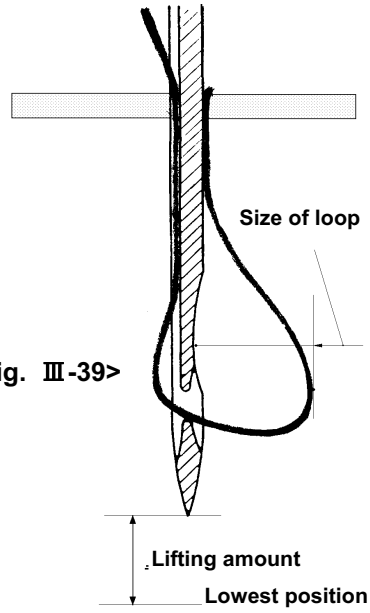
When DDL-5550N is adjusted to the timing marks, the respective values are :

a = 3.0 mm, b = 2.0 mm, and c = 1.0 mm.

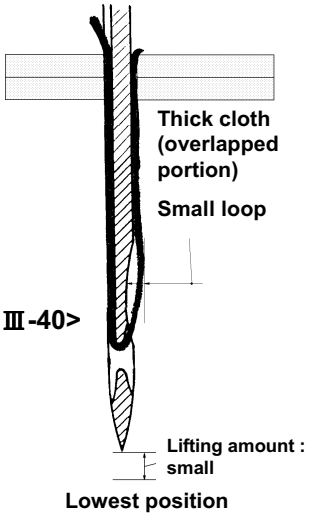
It may be required to change the adjustment values in accordance with materials (cloth and thread).

7) Needle thread loop

-1 When needle goes up from its lowest position, loop is formed by resistance of cloth.



<Fig. Ⅲ-39>



<Fig. Ⅲ-40>

-2 Size and shape of loop

a : Loop is small.

- Lifting amount is small.
- Thread is bad. → Stretch of thread is excess
- Cloth is flopped → Fixing of cloth is bad. (Overlapped portion or the like)

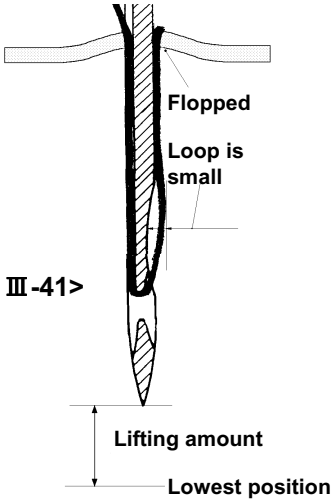
  Resistance is excessively strong. (Needle pierces material yarn, or the like.)
- Resistance of cloth is small. → Texture is coarse.

  Extra light-weight materials.

  Needle is too thick.
- Resistance of cloth is excessive. (Since thread is stretched.)

  → Extra heavy-weight materials

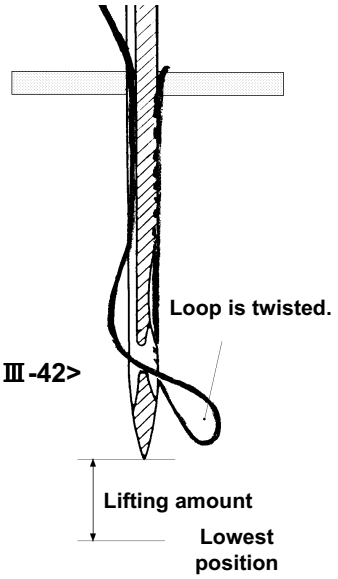
  Resistance of penetration is high.



<Fig. Ⅲ-41>

b : Loop is twisted.

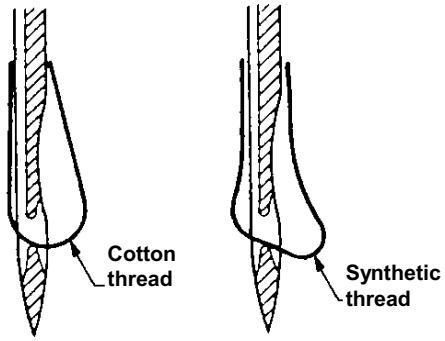
- Lifting amount is large.
- Thread is bad. → Thread is easily twisted (twist is strong.).
- Shift of twist of thread is many.



<Fig. Ⅲ-42>

c : Shape of loop according to thread

- Synthetic thread is apt to make a large loop of lower swollen shape.



<Fig. Ⅲ-43>

8) Thread-winding amount of various bobbins **<Table Ⅲ-8>**

	DB For DB hook	HSM Lockstitch double capacity hook	DBL Lockstitch 3-fold capacity hook	DP For DP hook	12 to 15 Vertical hook	12 to 15 Vertical double capacity hook
Spun #80	60m	110m	165m	65m	70m	120m
#60	45m	80m	120m	50m	60m	110m
#50	40m	70m	110m	40m	50m	90m
#30	23m	40m	65m	25m	25m	45m
#20	15m	27m	40m	17m	17m	30m
#8	10m	17m	25m		12m	20m
Filament #80	135m	210m	365m	140m	180m	320m
#60	110m	200m	300m	120m	145m	260m
#50	75m	135m	200m	75m	90m	160m
#30	32m	57m	85m	35m	45m	80m
#20	20m	35m	55m	25m	25m	45m
#8	15m	27m	40m		20m	35m

* Numerical values given in this table show when thread is wound around the bobbin by 80 to 90 %.

3. Thread take-up lever

1) Function

① Provides needle with upper thread.

② Supplies necessary amount of thread so that hook can scoop upper thread and so that the upper thread can pass through inner hook.

③ Lifts upper thread quickly when upper thread passes through inner hook.

④ Feeds out upper thread to be consumed for stitches together with feed dog.

⑤ Performs thread-tightening.

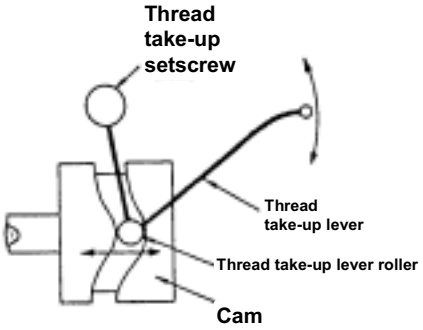
2) Kind of thread take-up lever

① Cam type thread take-up lever **<Fig. Ⅲ-44>**

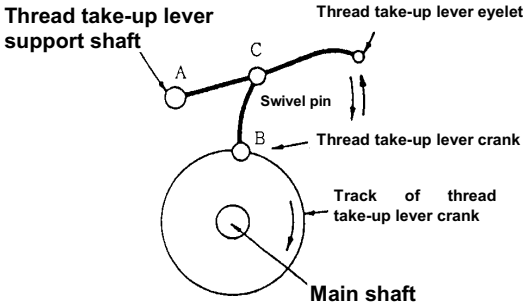
Thread take-up lever moves up and down by means of cam fixed on main shaft.

Thread tightening is very finely performed, and this type is largely used for leather and heavy-weight materials.

This is used for the old home-use sewing machines. In addition, this is not suitable for high-speed.



<Fig. Ⅲ-44>



<Fig. Ⅲ-45>

② Link type thread take-up lever **<Fig. Ⅲ-45>**

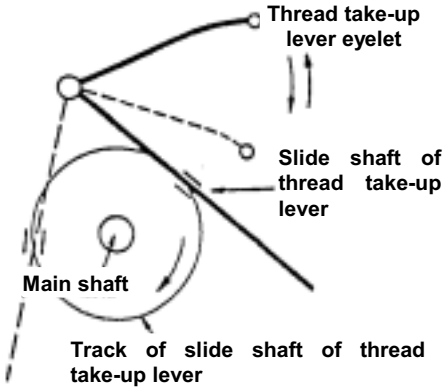
Thread take-up lever crank is rotated by means of rotary motion of main shaft and thread take-up lever moves up and down.

This type is used the most for general lockstitch sewing machines.

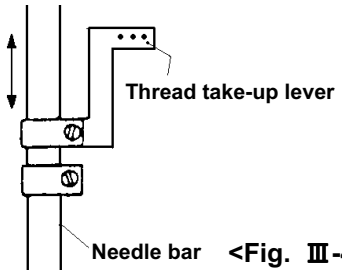
③ Slide type thread take-up lever **<Fig. Ⅲ-46>**

Slide shaft of thread take-up lever is rotated by means of rotary motion of main shaft and thread take-up lever moves up and down. This makes good thread tightening and is used with vertical hook for heavy-weight materials.

However, this is not suitable for high-speed. (Approx. up to 3,500 spm)



<Fig. Ⅲ-46>



<Fig. Ⅲ-47>

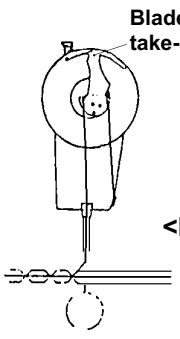
④ Needle bar type thread take-up lever **<Fig. Ⅲ-47>**

This is directly mounted to needle bar and performs same motion as that of needle bar. This is used for chainstitch sewing machines.

⑤ Rotary thread take-up lever **<Fig. Ⅲ-48>**

Blade-like thread take-up lever is rotated by means of rotation of counter weight mounted to main shaft and loosening and lifting of upper thread can be performed.

This makes good-looking stitch tightness and is used largely for zigzag stitching (foundation).

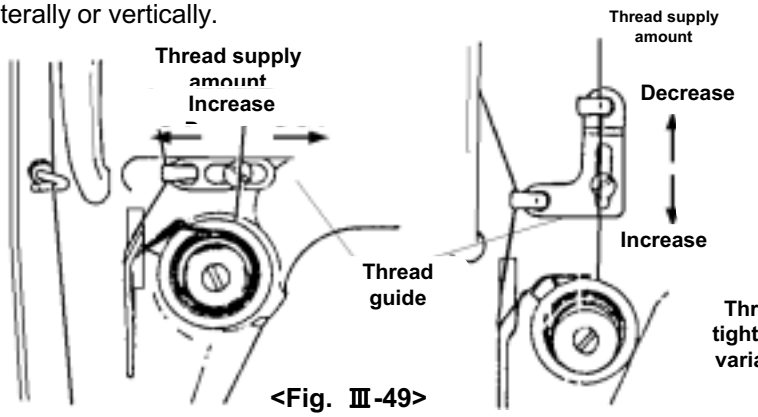


<Fig. Ⅲ-48>

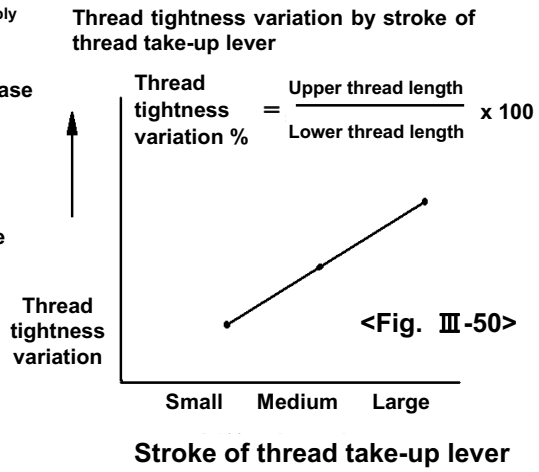
3) Stroke of thread take-up lever (Thread supply amount)

Thread supply amount from upper dead point to lower dead point of thread take-up lever is called stroke of thread take-up lever. Normally, the stroke is small for light-weight materials and large for heavy-weight materials. When the stroke is small, thread tightness is improved.

For the adjustment of stroke of thread take-up lever, it can be performed by moving arm thread guide laterally or vertically.



<Fig. Ⅲ-49>

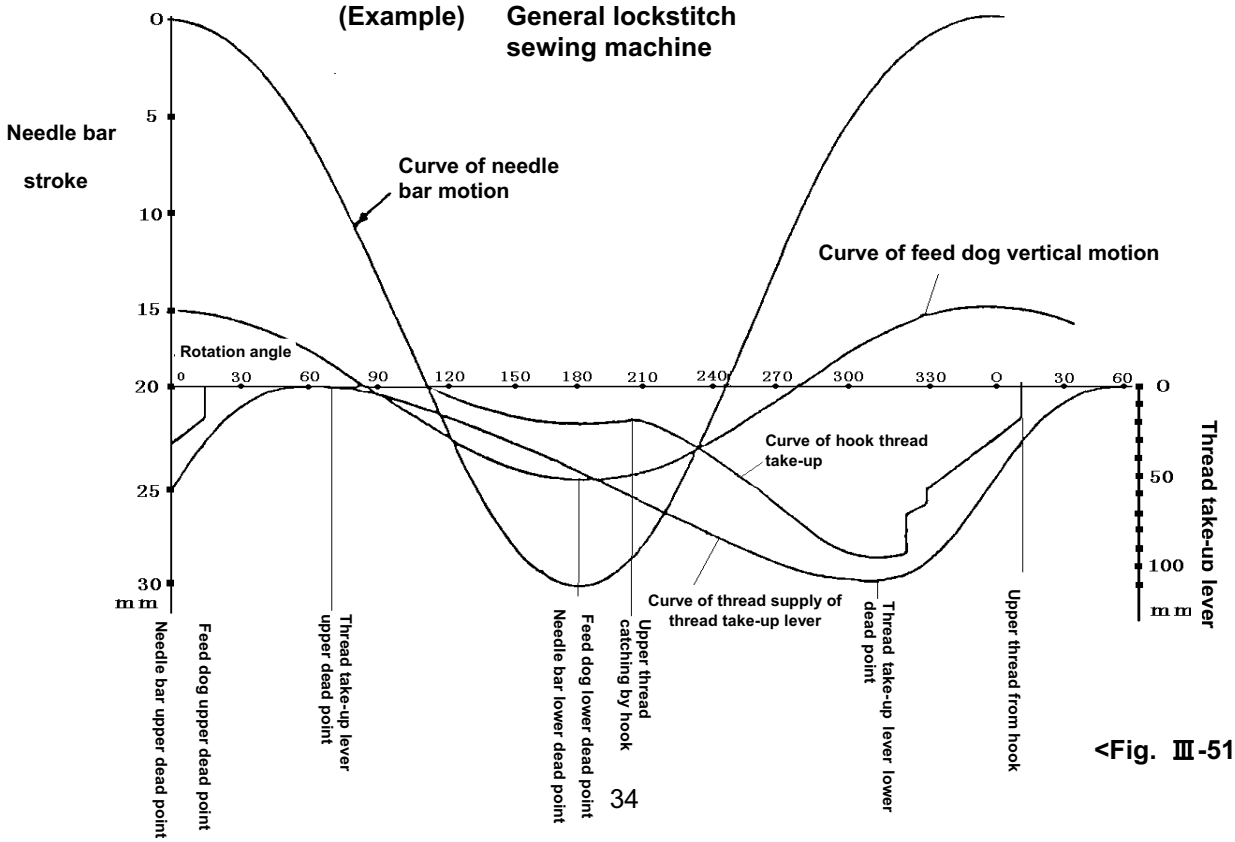


<Fig. Ⅲ-50>

When sewing heavy-weight materials, move thread guide to the left or lower direction to increase thread supply amount. When sewing light-weight materials, move thread guide to the right or upper direction to decrease thread supply amount. For the standard adjustment of thread guide, thread guide should be positioned in a way that engraved marker line is aligned with the center of screw.

4) Motion diagram

This diagram shows the static motion of 360° per rotation, while making needle bar upper dead point as 0°, regarding the motion of needle bar and feed dog, how hook draws needle thread, how needle thread passes through hook, and how thread take-up lever supplies and lifts needle thread.



<Fig. Ⅲ-51>

4. Feed dog

1) Function

① Makes the sewing product move per stitch.

② Can change amount to move and forms stitches suitable for the sewing product.

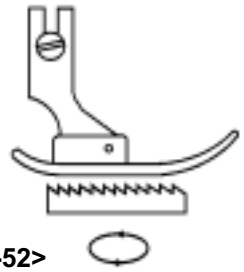
③ Stretch stitching or gathering stitching can be performed by means of feed mechanism, and prevention of puckering, gathering, etc. can be performed.

2) Kind of feed mechanism

① Bottom feed

This is the most standard feed mechanism, which feeds material with lower feed dog only.

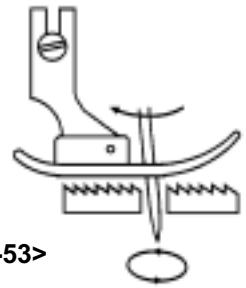
Uneven material feeding is likely to occur because of bottom feed only. However, sharp curve stitching can be easily performed and material handling is easy.



<Fig. Ⅲ-52>

② Needle feed (Bottom feed + needle feed)

This is the feed mechanism which needle bar moves in synchronization with bottom feed. Feeding force is strong, and this type can feed material more precisely than the aforementioned bottom feed type sewing machine. Uneven material feeding is reduced, but, stitch shrinking due to thread tightness is likely to occur.



<Fig. Ⅲ-53>

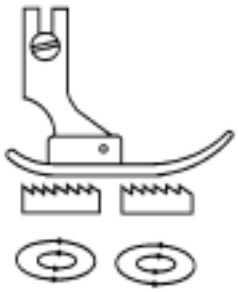
③ Differential feed (Front bottom feed + rear bottom feed)

This is the bottom feed mechanism, but feed dog is divided into front and rear. This is the feed mechanism which is possible to intentionally stretch material or gather material by changing feed amount of front feed dog and rear feed dog. This is suitable for sewing elastic knit.

Differential feed ratio of MO (overlock sewing machine)

Gathering 1 : 2 (Max. 1 : 4)

Stretching 1 : 0.7 (Max. 1 : 0.6)

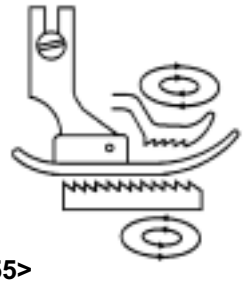


<Fig. Ⅲ-54>

④ Bottom and variable top feed (bottom feed + top differential feed)

There is a feed dog on the top side in terms of bottom feed, and top feed amount can be adjusted simultaneously together with adjustment of material feed from the bottom side.

Accordingly, this is the feed mechanism which is possible to prevent sewing slippage, and to perform edging contracting or gathering.

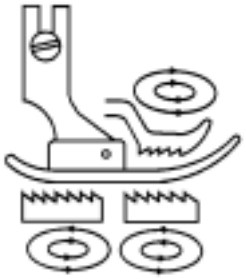


<Fig. Ⅲ-55>

⑤ Differential bottom feed and variable top feed

(differential feed + top differential feed)

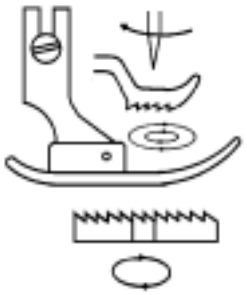
Bottom feed is differential feed, and top feed amount can be adjusted simultaneously together with adjustment (stretching and gathering) of material feed from the bottom side. Accordingly, this is the suitable mechanism which can give most suitable feed amount to the upper and lower materials.



<Fig. Ⅲ-56>

⑥ Unison feed (bottom feed + top feed + needle feed)

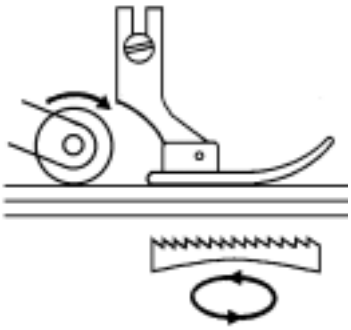
Feed force of this mechanism is most superior and this feed mechanism is largely used for extra heavy-weight materials or the like.



<Fig. Ⅲ-57>

⑦ Others

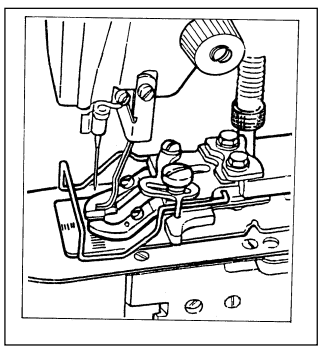
- With cloth pulling roller ... Roller located in the rear of presser foot pulls materials and sewing is performed. Uneven material feeding is reduced and working property is improved.



<Fig. Ⅲ-58>

- Fixed feed ... This is the feed mechanism to feed materials in a fixed state by holding materials between lower plate and upper plate.

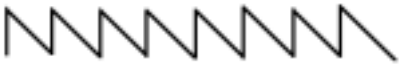
  (Example : cycle machine and automatic machine)



<Fig. Ⅲ-59>

3) Kind of feed dog

① Angle feed dog ... This is a feed dog generally used in large. The shape is strong in feed force of normal feed.

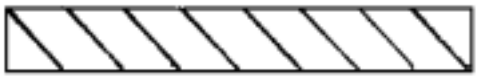


<Fig. Ⅲ-60>

② Double-cut feed dog ... It is good to fix materials laterally. This is used for upper feed dog of zigzag sewing machine, and top and bottom feed sewing machine.

<Fig. Ⅲ-61>

③ Slant tooth (helical tooth) feed dog ... The shape is hard to make feed dog defect on materials. This is used for top and bottom feed sewing machine (cloth puller type).



<Fig. Ⅲ-62>

④ Urethane rubber feed dog ... Feed dog defect is not made on materials. This is suitable for materials on which feed dog defect is easily made or yarn of cloth is caught with feed dog.

<Fig. Ⅲ-63>

4) Shape of feed dog (with respect to angle feed dog)

① Shape of top end

- Sag at the top end of tooth (width is 0.1 mm or more and rounding)

Catching of material is deteriorated and decrease of feed force, uneven pitch or material slippage will occur.

Corrective measure : Grind the top end using grind stone or the like.

- Top end of tooth is sharp as a blade.

Scratch on material, thread breakage or chain-off thread breakage will occur.

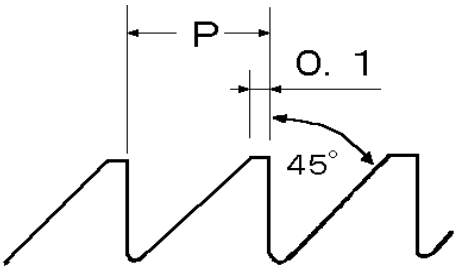
Corrective measure : Lightly grind the surface of tooth using grind stone or the like and buff there.

- Surface of feed dog is not even. Or, it is not levelled.

Corrective measure : Correct it using grind stone or the like.

Feed dog comes in single-side contact with materials and straight feeding is deteriorated.

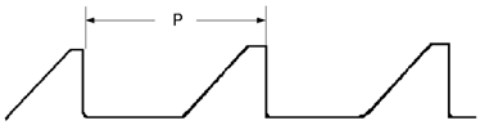
Corrective measure : correct using grnid stone or the line.



<Fig. Ⅲ-64>

② Pitch (P)

- For lockstitch : Slim pitch 1.15 mm Standard 1.5 mm Coarse pitch 1.8 mm
- For MO : Slim pitch 1.15 mm Standard 1.6 mm Coarse pitch 2.0 mm
- For extra heavey-weight materials : 2.5 mm to 4.5 mm



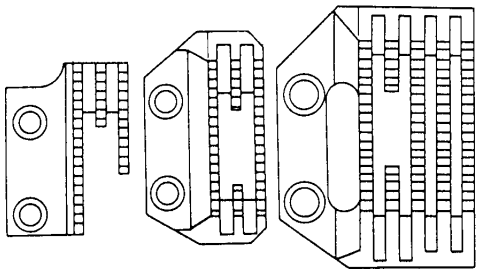
<Fig Ⅲ-65>

◎ Slim pitch : This is suitable for light-weight and soft materials. If this pitch is used for heavy-weight materials, bite to materials is deteriorated and feed force becomes insufficient.

◎ Coarse pitch : This is suitable for thick and hard materials in some degree. If this pitch is used for light-weight material sewing, it will be a cause of puckering.

③ Number of teeth (rows)

- The less the number of teeth (rows) is, the better the sharp curve stitching becomes.
- The more the number of teeth (rows) is, the better straight feeding, feed force and stability of materials become.
- When feed dog is located at this side of hole of throat plate, feeding to overlapped section and bite at the start of sewing are improved.



<Fig. Ⅲ-66>

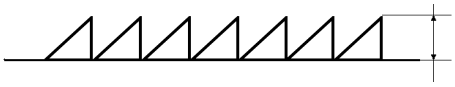
- For the elastic materials such as knit or the like, it is likely to be good to feed materials at the front or rear of needle entry. If there is no feed dog on this side, the material is in the state that it is pulled by the feed dog located in the rear of needle, and the material is sewn while it is somewhat stretched.

5) Tilt and height of the feed dog

① Height

Adjust the height to 0.5 mm to 1.2 mm (standard : 0.8 mm) in accordance with materials to be sewn.

For sewing machines for extra heavy-weight materials = adjust to 1.2 mm to 1.5 mm.



<Fig. Ⅲ-67>

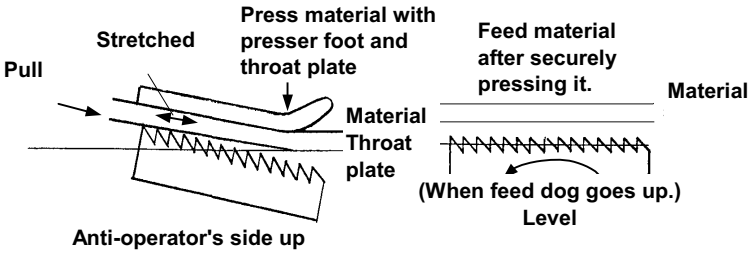
If the height is too high : Feed force is good. However, puckering may easily occur.
⇒ This is suitable for heavy-weight material sewing.

If the height is too low : Feed force is bad. However, puckering may not easily occur.
⇒ This is suitable for light-weight material sewing.

① Tilt

Generally, it is the standard that the feed dog is flush with throat plate surface when the feed dog goes up from throat plate surface or it comes down from throat plate surface.

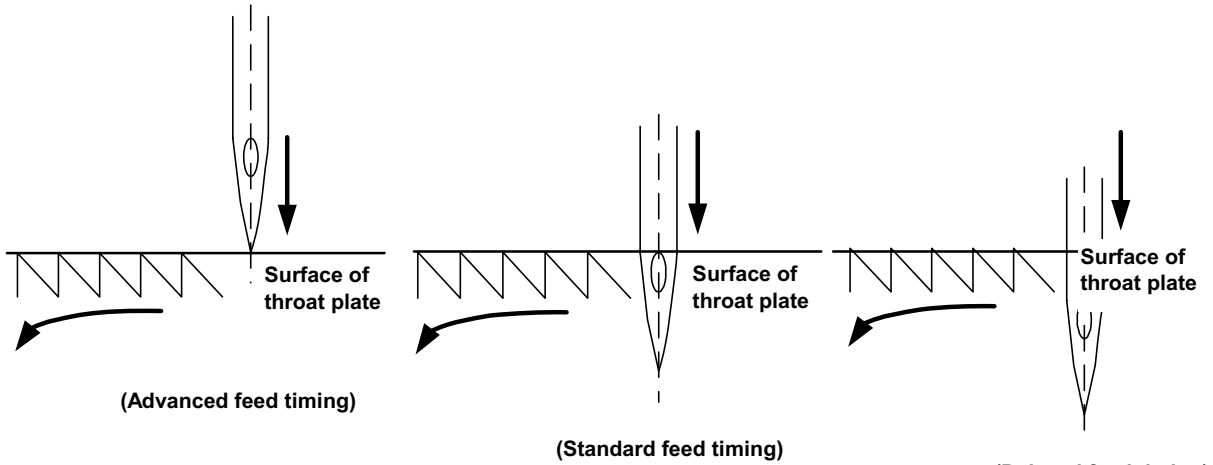
When tilting the feed dog with its anti-operator's side up (up in the opposite side of needle), cloth puller effect appears and puckering decreases.



<Fig. Ⅲ-68>

6) Feed timing

Check the timing at the position where needle tip ((needle eyelet) is when feed dog comes down.



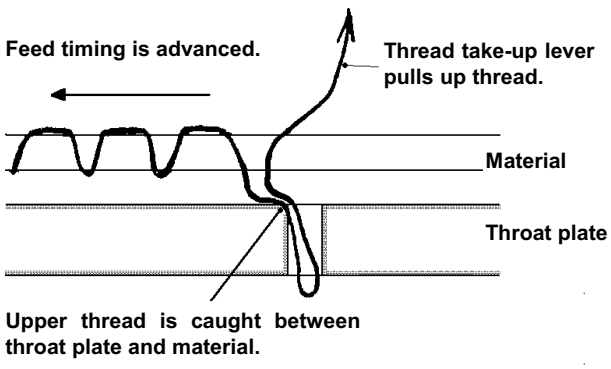
<Fig. Ⅲ-69>

① When feed timing is advanced **<Fig. Ⅲ-70>**

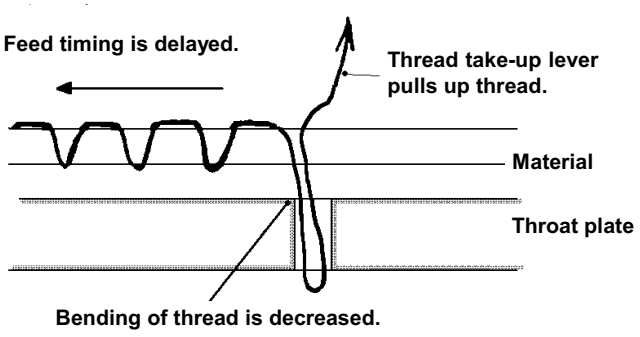
If the feed timing is advanced when thread is pulled up with thread take-up lever, thread is caught between throat plate and material and thread tightness is deteriorated.

② When feed timing is delayed **<Fig. Ⅲ-71>**

Bending of thread is decreased and upper thread tightness is improved. However, if feed timing is excessively delayed, needle wobbling occurs, resulting in needle breakage.



<Fig. Ⅲ-70>



<Fig. Ⅲ-71>

5. Presser foot

1) Function

① Stabilizes materials to sew jointly on the surface of throat plate, and determines the sewing position.

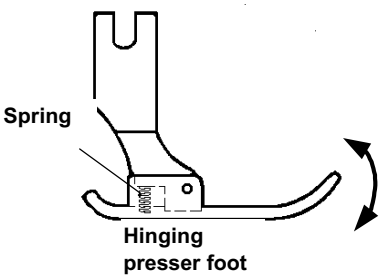
② Presses the materials so that materials are not lifted with the needle when needle comes out of materials.

③ Makes materials come in close contact with teeth of feed dog with adequate pressure so that the sewing direction is not disturbed when feed dog feeds materials forward or backward.

2) Kind of presser foot

There are many kinds of presser foot so that it can be used properly in accordance with kind of material or sewing process.

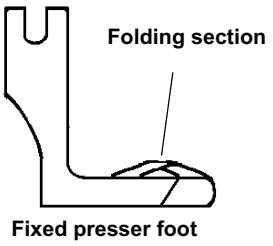
Kinds of the typical presser foot are described as follows.



<Fig. Ⅲ-72>

① Hinging presser foot

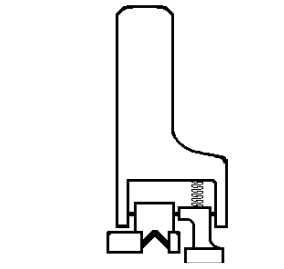
This is the most standard presser foot, and a spring is mounted in the rear of the presser foot so that its front part is up. This corresponds well to materials and feeding at overlapped section is smooth.



<Fig. Ⅲ-73>

② Fixed presser foot

This is largely exclusively used for 2-fold, 3-fold piping, etc. Stability of folding or the like is good, however, feeding at overlapped section is deteriorated.



<Fig. Ⅲ-74>

③ Compensating presser foot

This is a guide presser exclusively used for stitch sewing. There are three shapes for left-side overlapped section, right-side overlapped section and use of both sides. There are many kinds so as to correspond with numerous stitch widths.

④ Sliding presser foot

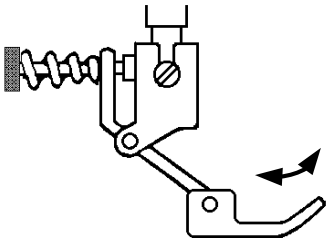
This presser foot moves forward or backward by means of up/down of feed dog, and it is effective to prevent uneven material feeding.

(MH-481 : B1524-481-CD0)

(For general lockstitch sewing machine : B1524-227-AA0)

(For general lockstitch sewing machine : MAA-015000A0

= Front/rear adjutment of foot sole type)



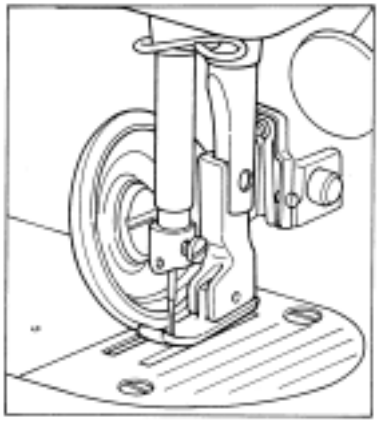
<Fig. Ⅲ-75>

⑤ Other special presser feet

• Roller presser :

This is used for leather sewing. Rotating roller synchronizing with bottom feed instead of presser sole is located at the side of needle entry, and presses and feeds materials to be sewn.

This can be called a kind of top and bottom feed.

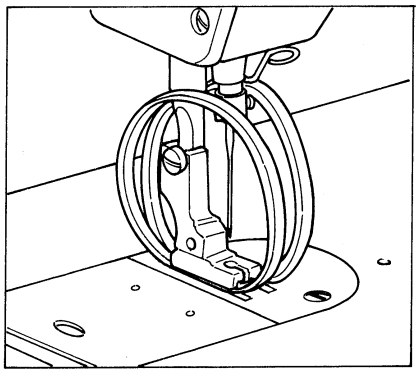


<Fig. Ⅲ-76>

• Ring roller presser :

Nylon rings attached to both sides of presser rotate in synchronization with bottom feed, and feed materials.

This can be called a kind of top and bottom feed.



<Fig. Ⅲ-77>

3) Thread path recess

Recess on the wrong side of presser foot is made to decrease resistance and lift the thread smoothly when thread take-up lever lifts upper thread.

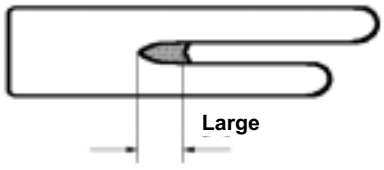
Length of this recess varies according to the kind of presser foot. It is necessary to use a proper presser foot in accordance with thickness of thread or stitch length.

① Large recess

(DDL-5530N, DDL-5550N standard : B1524-012-0BA)

This type does not press stitch (knotting point of upper and lower threads), and thread tightness is improved. However, if this presser foot is used when stitch length is small or sewing light-weight materials, puckering may occur.

Recommended feed pitch is approximately 4 mm.



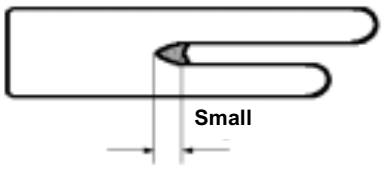
<Fig. Ⅲ-78>

② Small recess

(DDL-5550NA for light-weight materials : D1524-555-DBA)

When feed pitch 3 mm exceeds, defective thread tightness is apt to occur. It is necessary to replace the presser foot with one with large recess or to grind the recess to make it longer.

Recommended feed pitch is 2 mm to 3 mm.

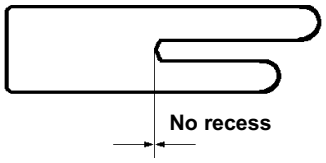


<Fig. Ⅲ-79>

③ No recess

(For extra light-weight materials : B1524-012-TBA)

This is effective for preventing puckering caused by excessive thread tightness when sewing extra light-weight materials. Be careful about sudden defective thread tightness.



<Fig. Ⅲ-80>

4) Surface treatment

① Standard presser foot : Nickel plating, chrome plating

② Special presser foot : Teflon presser foot ... This is effective to prevent uneven material feeding because of smooth sliding. However, it is inferior in the wear proof since the presser sole is teflon itself. (Presser sole only : D1524-126-W0B)

(For lockstitch sewing machine : D1524-126-WBA)

Teflon treatment presser foot ... Smooth sliding presser sole of special light alloy including teflon is used, and this is effective to prevent uneven material feeding. And, this is superior to the teflon presser foot in the wear proof.

For lockstitch sewing machine

MAA-05000AA0 (PF-1) = For standard sewing

MAA-05000BA0 (PF-2) = For medium- and heavy-weight material sewing

MAA-05000CA0 (PF-3) = For light-weight material sewing

5) Pressure of presser foot

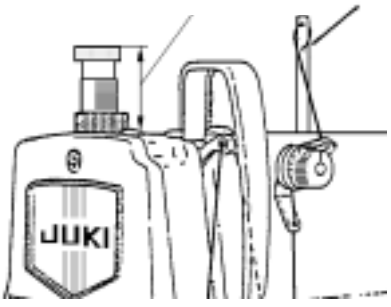
① Relation between height of presser foot and pressure of presser foot **<Table Ⅲ-9>**

Pressure of presser foot : Kg		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Height of presser spring regulator mm	For light-weight materials B1505-227-T00A	40	36	33	30	27	24	21	19			
	For standard B1505-227-000A		42	40	38	37	35	34	32	30	28	26

Distance from top surface of sewing machine arm to top end of presser spring regulator (mm)

When the pressure of presser foot is high, feeding force is increased. However, uneven material feeding or feed dog mark on the cloth is likely to occur. Adjust the pressure to the lower level especially for the light-weight material sewing or the like to sucn an extent that the material feeding is not difficult.

Height of presser spring regulator



<Fig. Ⅲ-81>

② Kinds of presser spring

For standard sewing machine : B1505-227-000A (ϕ = 1.4 mm)

Pressure at the time of delivery : 4Kg When the strength ratio of this spring is regarded as [1],

For sewing machine for light-weight materials : B1505-227-T00A (ϕ = 1.2 mm) Pressure at the time of delivery : 4Kg (type A)

1.5Kg (type E) Strength ratio to standard spring [0.57]

For sewing machine for extra light-weight materials : 111-62104 (ϕ = 1.0 mm) optional Strength ratio to standard spring [0.28]

For NF sewing machine : 111-05202 (ϕ = 0.9 mm)

Pressure at the time of delivery : 1Kg Strength ratio to standard spring [0.19]

6. Thread tension

1) Function

This gives a proper tension to upper thread and lower thread among the various sewing conditions, and interlaces upper thread and lower thread in the approximate center of cloth to form beautiful stitches.

2) Adjusting points of thread tension

First, adjust the lower thread tension.

Low tension ... it is effective for reduction of puckering, wobbling prevention, and improving appearance.

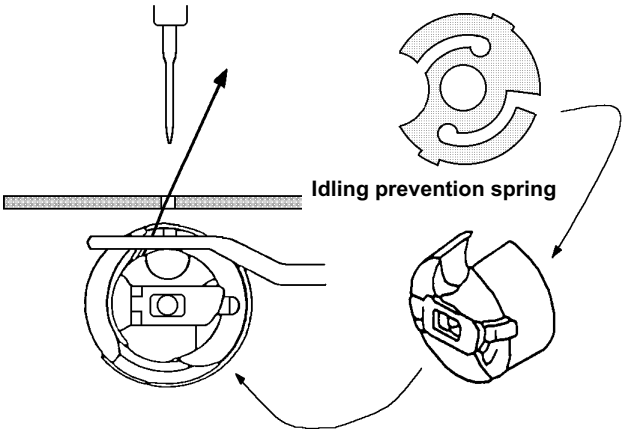
High tension ... it is effective for reduction of uneven stitches and decrease of bobbin idling.

① Measuring bobbin thread tension

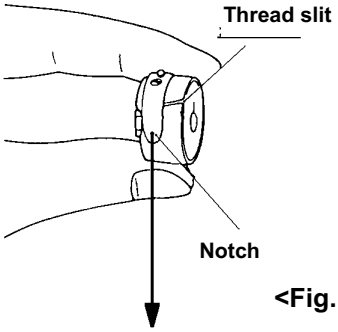
Set bobbin case to the sewing machine as shown in the illustration, and draw up bobbin thread from the needle hole in throat plate in the slanting upper direction of this side. Then, measure the tension at the unit of gf (effective numerals : two digits) using tension gauge.

Set draw-out speed of thread to 10 to 30mm/sec.

Be sure to measure it in the state that the needle bar is near its upper dead point so that bobbin thread does not come in contact with the outer hook.



<Fig. Ⅲ-82>



<Fig. Ⅲ-83>

In case of springless bobbin case, measuring may be performed at the position of the above illustration.

* Notch for spring rotation prevention is attached to bobbin case with idling prevention spring, and the depth of the case is wider than the standard as deep as the thickness of the spring (0.1 mm).

Thread tension adjustment value **<Table Ⅲ-10>**

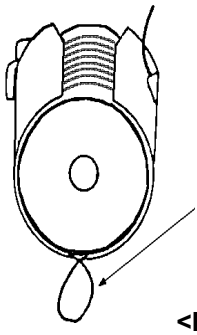
	Bobbin thread tension	Thread take-up spring tension	Stroke (thread absorption amount)
Spun #80 Tetoron #80, #60	10 to 25 g	5 to 15 g	9 to 14 mm
Spun #50, #60 Tetoron #50	15 to 30 g	10 to 20 g	8 to 13 mm
Spun #30 Tetoron #30	20 to 40 g	20 to 30 g	6 to 11 mm

- Adjustment value of bobbin thread tension in terms of thread used for 1-needle lockstitch sewing machine, thread take-up spring tension, or stroke (thread absorbing amount) slightly varies in accordance with the sewing machines. Especially, stroke of thread take-up spring varies.

For the respective adjustments, refer to V) Adjustment procedures.

② Idling of bobbin

Idling bobbin causes the bobbin thread to come off as shown in the illustration and thread breakage or irregular stitching occurs.



Bobbin thread comes off.

<Fig. Ⅲ-84>

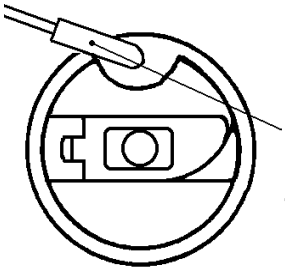
Corrective measures :

- Reduce bobbin thread winding amount.
- Replace with a lighter bobbin. (Aluminum bobbin or the like)
- Use a bobbin case with idling prevention spring.
- Decrease sewing speed.
- Use a bobbin case and a bobbin which are in the state that the clearance between them is small. (Do not use the market-available ones.)

◎ Cause that idling occurs

-1 Idling at the time of thread trimming

Idling occurs since bobbin thread is quickly pulled when the moving knife handles bobbin thread.



Bobbin positioning finger

<Fig. Ⅲ-85>

[Corrective measure other than the aforementioned corrective measures」

Adjust so that the bobbin positioning finger securely presses the bobbin at the time of thread trimming.

－２Idling due to vibration of sewing machine rotation

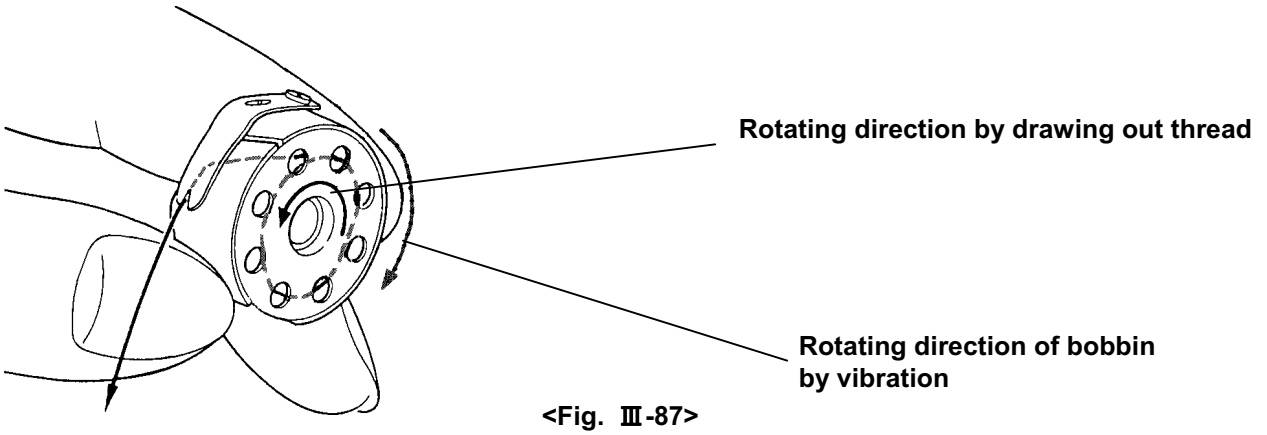
Bobbin of almost every sewing machine rotates in the hook rotating direction by the vibration. Therefore, idling occurs.

<Fig. Ⅲ-86>

Bobbin rotating direction

[Corrective measure other than the aforementioned corrective measures]

Set bobbin to bobbin case in the direction where bobbin thread is pulled by the rotating force of the bobbin.



<Fig. Ⅲ-87>

-3 To form stitches

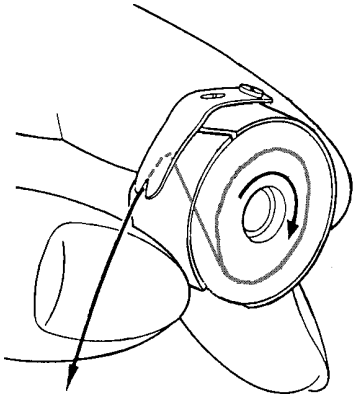
Idling occurs when forming stitches or when bobbin thread is fed by the feed dog and thread tightenning.

This is a phenomenon that is likely to occur in case of thread that is easily twisted or thread the move of twist of which occurs easily.

[Corrective measure other than the aforementioned corrective measures]

Set bobbin so that the bobbin thread does not come off even when the bobbin idles.

Generally, setting as shown in the right illustration is proper for bobbin thread come-off prevention. However, there are some threads which are proper when setting the bobbin in the reverse direction.



<Fig. Ⅲ-88>

③ Change of bobbin thread tension due to bobbin thread remaining amount

(when idling prevention spring is used.)

The higher the idling prevention spring pressure is, the larger the change of bobbin thread tension due to bobbin thread remaining amount is. Accordingly, a phenomenon that the less bobbin thread remaining amount is, the worse thread tightening is occurs.

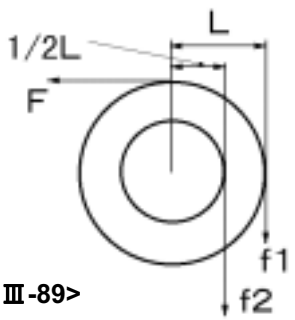
(The bigger the hook is, the larger change of the tension is.)

Accordingly, it is desired that the pressure of idling prevention spring should be low to such an extent that bobbin thread does not idle.

[Remarks] Why such a phenomenon occurs when the pressure of idling prevention spring is high.

F = Force the bobbin thread comes out

f1, f2 = Force bobbin thread desires to stay there



<Fig. Ⅲ-89>

(Pressure of idling prevention spring)

L = Distance from the center when bobbin thread is fully wound

1/2 L = 1/2 distance of L

F > f1 x L ... ①

The above force is necessary when bobbin thread comes out from bobbin.

And, if the sewing continues, the bobbin thread remaining amount continues to decrease.

Even when the bobbin thread remaining amount reaches 1/2 L, the force,

F > f2 x 1/2 L .... ②

is necessary. In addition,

f1 x l = f2 x 1/2 L ... ③

is formed even the same bobbin since the same sewing is being performed. Accordingly, a formula,

F > f1 x L = f2 x 1/2 L

is introduced from ①, ② and ③.

If f1 = 1 g (pressure of idling prevention spring = 1 g), f2 = 2 g.

The difference is 1 g (2 g - 1 g = 1 g). However, if f1 = 10 g (pressure of idling prevention spring = 10 g), f2 becomes 20 g, the difference is 10 g (20 g - 10 g = 10 g).

The difference of 10 g is not much for the thick thread heavey-weight material sewing. However, for the thin thread light-weight material sewing, sewing quality differentiates.

<<Conclusion>>

When considering the sewing stability, the ideal is sewing without idling prevention spring. However, the idling prevention spring is absolutely necessary to prevent sewing from trouble due to bobbin thread idling. It is needless to say that thorough control of spring pressure is necessary to protect demerit due to the idling prevention spring.

3) Thread controller

① Function

Adjusts the needle thread tension so that the stitchs are formed in the approximate center of the cloth.

② Kinds

＊ Tension disk type ... This is used for almost all sewing machines.

Thread is passed between two pieces of tension disk and spring pressure is changed from one side to give tension to thread.

Accordingly, if thickness of thread changes, tension changes since contact strength between tension disk and spring changes.

The defect is that shift of thread twist is apt to occur since thread is stripped off by frictional resistance.

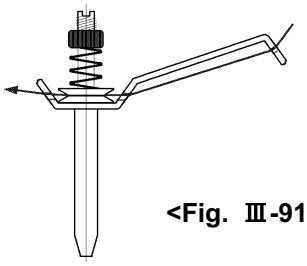
＊ Rotary tension type ... This is used for LZ-2280N series.

<Fig. Ⅲ-90>

This type winds thread one turn around roller, gives spring pressure from one direction and gives tension to thread by frictional torque of spring pressure and roller.

Change of tension due to thickness of thread is small, and thread can be supplied under stable tension. Further, shift of thread twist due to frictional resistance is small.

The defect is that when this type is compared with the thread tension disk type, thread is apt to come off from roller and difficult to be passed. Readjustment of tension may be necessary in accordance with the change of thickness of thread.



<Fig. Ⅲ-91>

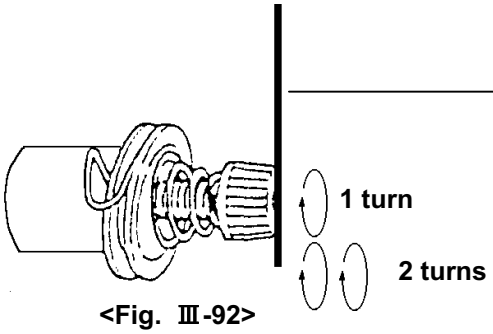
＊ 1st tension (thread guide post) ... (Part No. : D1113-126-WA0)）

This is effective for prevenstion of thread fluctuation, irregular stitch and balloon stitch.

Especially, effect appears for sewing under low tension of thin thread.

③ Relation between tightening position of tension nut and tension **<Table Ⅲ-11>**

Position of tension nut (turn)		0	1	2	3	4	5	6	7	8	9	10
Tetoron #80	Type A：D3129-555-D00	90g	15	30	40	55	75	85	105	120	150	190
	Standard：B3129-012-A00	10g	24	48	75	105	120	150	180	240	—	—
Spun #80	Type A：D3129-555-D00	12g	15	25	40	50	65	80	100	120	145	190
	Standard：B3129-012-A00	12g	22	45	65	85	110	135	160	210	—	—

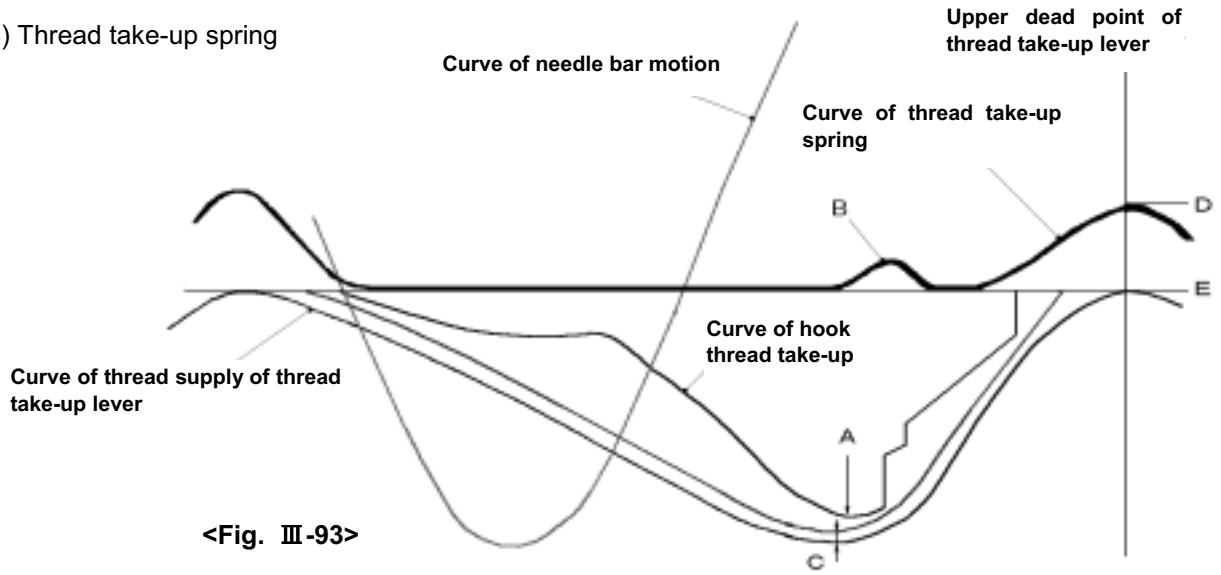


<Fig. Ⅲ-92>

Regard as "0" the place where end face of tension nut on this side is aligned with end of tension post.

Regard tightening of 1 turn as "1", and that of 2 turns as "2".

4) Thread take-up spring



<Fig. Ⅲ-93>

① Function

This spring gives elasticity between hook and thread, and absorbs the resistance force at point A where a large resistance is applied to thread. At this time, the motion of thread take-up spring works such a shape as B. Thread supply amount (slack) of thread take-up lever is absorbed as much as amount C by the thread take-up spring.

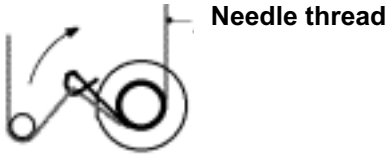
② Motion

The spring moves a little as B at point A (when hook pulls in needle thread at its maximum.) and moves to its maximum stroke as D at the upper dead point of thread take-up lever (when thread take-up lever is lifted to its maximum.).

· State of thread take-up spring at the time of D
(Thread supply state)

<Fig. Ⅲ-94>

· State of thread take-up spring at the time of E
(Thread absorption state)

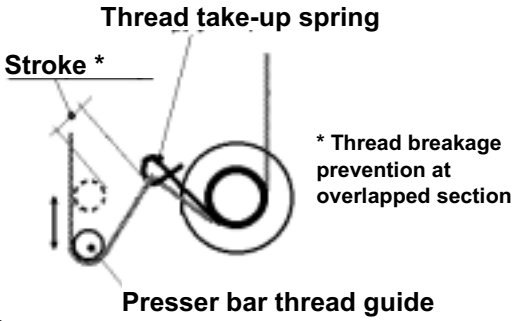


<Fig. Ⅲ-95>

③ Presser bar thread guide

This is connected to presser bar and moves up or down in accordance with up/down motion of feed dog and change of thickness of cloth to change the stroke of thread take-up spring.

When cloth gets thicker, presser bar thread guide goes up and stroke of thread take-up spring automatically becomes smaller.



<Fig. Ⅲ-96>

5) Needle bar thread guide

① Standard **<Fig. Ⅲ-97>** ... (Part No. : 110-05303)

This thread guide decreases thread fluctuation around needle tip, and is suitable for the feed pitch 3 mm or less with thin synthetic thread.

This guide may be the resistance when performing thread tightening by thread take-up lever at the time of thick thread and large feed pitch.

<Fig. Ⅲ-97>

② For thick thread and large feed pitch (H type) **<Fig. Ⅲ-98>** ...

(Part No. : B1418-415-H00)

Thread hole protrudes to this side and when using this guide, resistance is small at the time of thick thread and large feed pitch. In addition, thread tightening is improved.

<Fig. Ⅲ-98>

③ For extra thick thread **<Fig. Ⅲ-99>** ... (Part No. : 114-01619)

Thread hole protrudes to this side further than the aforementioned ②. This guide is suitable for extra thick thread and feed pitch 5 mm or more.

<Fig. Ⅲ-99>

④ For uneven stitch prevention **<Fig. Ⅲ-100>** ... (Part No. : B1418-227-T00)

This guide makes needle thread approach the needle as near as possible and stability of thread is good. Also, this guide is good for thread breakage prevention at the time of needle bent, uneven stitch, reverse feed stitching and idle stitching, and is suitable for synthetic thread and thin thread. However, threading is rather difficult and thread tightening is deteriorated with thick thread.

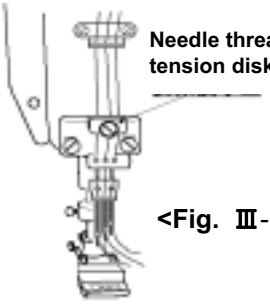
<Fig. Ⅲ-100>

6) Needle thread tension disk (weak spring or felt)

① Function ... Prevention of thread fluctuation at needle portion

- Prevention of piercing thread at needle tip
- Prevention of bite to hook (thread tension in terms of blade point of hook is increased.)
- Prevention of stitch skipping (when blade point of hook scoops needle thread, this disk gives resistance to thread to easily form loop. ... it is effective for idle stitching or drop stitching.)

* Set the tension to 3 to 5 g since thread tightening by thread take-up lever is deteriorated

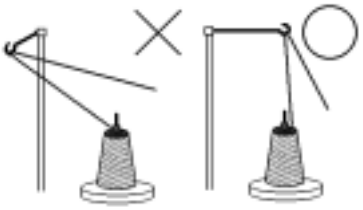


<Fig. Ⅲ-101>

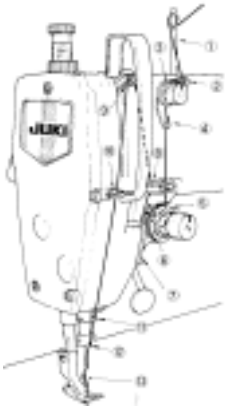
7) Threading

Pass thread properly as described in the Instruction Manual. And, set vertically "spool rest" and "spool pin".

Unevenness of thread tension occurs, resulting in irregular stitch or thread breakage.



<Fig. Ⅲ-102>



<Fig. Ⅲ-103>